Nuts & Volts

Exploring Electronics And Technology For The Hobbyist And Professional

www.nutsvolts.com

December 1999 Vol. 20 No. 12

Thank you to all of our readers, advertisers, and friends for your support this past year.

May the joy of the season be yours as we head into the new millennium.

U.S. $3.50 CANADA $5.00

12>

0 74470 89295 3

COPIES EVERYTHING PARTITIONS, O/S, THE WORKS!

SUPPORTS ALL INTERFACES SCSI, E-IDE, 2.5", SCA

BUILT-IN DATA RECOVERY SYSTEM

ELIMINATES DEFECTS ON SCSI AND IDE DRIVES

PARALLEL PORT PRINTS TEST RESULTS

INSTANTLY CLONES ANY SCSI OR IDE DRIVE

CLONE, TEST OR REPAIR ANY HARD DRIVE

"THE MOST COMPLETE HARD DRIVE WORKSTATION WE'VE SEEN!" BOB ROSENBLOOM, DIGITAL VIDEO, INC.

DRIVE SERVICE STATION

Copy entire hard drives with ease. Drive duplicators are essential tools for dealers and system builders. Don't spend hours installing and formatting drives. Do it instantly with the Pro. Set up any SCSI or IDE drive with your original software. Connect blank drives to the Pro and presss start. You'll copy entire drives faster and more accurately than is possible on any PC. With our combination IDE and SCSI model, you can even copy data between diffferent interfaces. All models include both 2.5" and 3.5" interface adapters. The Pro also supports SCA and Wide SCSI drives.

Choose the Pro, and you'll also have an entire factory drive test and repair system for under $1000. The Pro gives you the ability to copy, reformat, repair, translate, and test any hard drive. Use the Pro to put any hard drive through its paces. A full factory final test and performance analysis is performed. Complete test and repair reports are sent to any standard printer.

The Pro will also reassign and eliminate drive defects. Here's how it works: First, a precise media analysis system scans the disk for errors. Defects are mapped out, and effectively "erased." The error correcting system then "trains" the drive to permanently avoid defective areas. Data is stored only on the safe areas of the disk. Capacity is reduced by an insignificant amount, and the drive works flawlessly once again. Get the technology used by major repair shops and data recovery centers. The Pro repairs all disk defects caused by normal wear. Drives with mechanical damage may not be repairable.

BUY MANUFACTURER DIRECT: $995

408 330-5525

CSC

CORPORATE SYSTEMS CENTER

3310 WOODWARD AVE., SANTA CLARA, CA 95054

WWW.DRIVEDUPLICATORS.COM

Call today for high volume multi-drive copiers and CD Duplicators
Sold and intended for backup purposes only. Copyright laws must be observed.

Write in 153 on Reader Service Card.

HSC Electronic Supply

Serving Silicon Valley since 1964!

..brings you a potpourri of high-tech goodies for the techno-tinkerer!
For thirty years we have been your source for Silicon Valley exotica!

Attention Hams! HSC has QRP!

Announcing the newest development in the hottest field of interest in ham radio...QRP! Low power rigs are the latest rage, and we now have the giant-killer entry on the market...

The *MN9* 9-Band QRP Transceiver Kit!

by Sierra Radio Enterprises

Available EXCLUSIVELY at HSC Electronics!

For the Ham Radio buff who likes to build his own rig, we offer this technically advanced transceiver that is fun to build and a dream to operate. Containing many features found only in upper-end transceivers, this is not an entry-level kit, although you will need no exotic test equipment to align and test. This will provide several evenings of enjoyable kit-building, and many more operating at the low-power end of the spectrum! Note: you should be fairly confident in your kit-building abilities before attempting this!

- **50 mW to 12 Watts - CW / SSB**
- **USB,LSB, CWHI, CWLO (selectable CW sideband)**
- **160 meters thru 10 meters, including WARC Bands**
- **Digital Frequency / Clock Display**
- **Vackar VFO with ZERO DRIFT! ***
- **Built-in Electronic Keyer -- Built-in SWR Bridge**
- **Front-firing speaker, handsome front panel**
- **Full QSK CW Break-in, two jacks for paddle & key**
- **Narrow-band CW filter option**
- **Dual, Half-Lattice 9 MHz Xtal filter for SSB**
- **Variable RIT/XIT, Selectable IF Scan with Scan Adjust for filter rejection of unwanted signals.**
- **NO RELAYS! -- No external test equipment needed for alignment!**
- **Tuning Versatility!...Adjustable bandspread, both in width and in Ham-Band Position!**
- **Once a given bandspread is chosen...set the limits and USE!**
- **Estimated ship date for preliminary release December 1**

*by adjusting two rear-panel mounted pots

HSC#80503 **$499.00**

Price Breakthrough on Variable Transformers!

You say you've wanted one of these in the past, but the price kept you away? Now you can afford a brand-new variable AC supply for your workbench! All have enclosed cases, knob and dial.

- Model AICVR-500W, 120 VAC input
- 0 - 120 VAC ouput, 500 watts
- Measures 5" dia., 6" tall
- Features meter, binding post terminals for input, output
- New in box, made in China

HSC#80474 **$50.00**

- Model AEEC-1090VR, 120 VAC 60 Hz input
- 0 - 120 VAC output, 1 KVA
- Measures 6.5" dia., 8" tall
- Features meter, illuminated switch, line cord, fuse
- New in box, made in China

HSC#80481 **$85.00**

- Model AEEC-2090VR, 120 VAC 60 Hz input
- 0 - 120 VAC output, 2 KVA
- Measures 8" x 10" x 8" tall
- Features meter, illuminated switch, line cord, fuse
- New in box, made in China

HSC#80461 **$125.00**

External SCSI Drive Cases

- Small vertical-format case for 3.5" drives, brand new!
- 3.75" x 5.5" x 9.75" overall size
- 50-pin SCSI connectors
- SCSI ID switch, termination switch
- Universal input 40W Power supply
- Fan-cooled, uses standard IEC Power cord (not included)

HSC# 18075 **$24.95**

- High-power case for 5.25" drives, brand new!
- 7" x 4.5" x 10.5" overall size
- 50-pin SCSI connectors
- SCSI ID switch
- 65W Power supply (lots of power for hard drives, etc.)
- Fan-cooled, uses standard IEC Power cord (not included)

HSC# 17130 **$39.95**

- High quality low profile case for 5.25" drives, brand new!
- 7" x 2.25" x 11" overall size
- 50-pin SCSI connectors, RCA Audio connectors
- SCSI ID switch, termination switch
- *Tiny* 12W Power Supply (5VDC @ 1.4A, 12VDC @ .4A, probably only good for CD-ROM's)
- Fan-cooled, uses standard IEC Power cord (not included)

HSC# 17357 **$29.95**

ATX Power Supply Special!

- "Sparkle Power" 235W fan-cooled ATX supply
- Perfect for ATX Tower & Mid-Tower Cases
- Input: 100-120VAC - 7A/200-240V - 4A, 50-60Hz
- Output: 3.3VDC/14A, +5Vsb/0.8A, +5VDC/22A, -5VDC/0.3A, +12VDC/8A, -12VDC/0.8A
- Power-Good signal line, Noise suppression
- Standard ATX-motherboard, disk drive power connectors
- Measures 3.375" x 5.5" x 6" (Standard ATX Form-Factor)
- New, 90-day warranty

HSC#18108 **$19.95**

ISA to SCSI Adapter

- Adaptech model AVA-1505AI -- Brand Name Quality!
- Single, complete PC connection
- For *single* non-bootable SCSI2 peripheral
- New, OEM pack, with install diskette & manual

HSC#17995 **$17.50**

Special! ...w/DB25 adapter & cable **$19.95**

Sidewinder Slashed!

- Microsoft "Sidewinder" game controller ... Wow!
- New,OEM package, high quality for fast action!
- Download drivers from Microsoft.com
- Eight programmable action buttons, two fire buttons

HSC#80486 **$17.50**

ATX-Style Mid-Tower!

- Need a case for your motherboard?
- ATX-style mid-tower cabinet
- ATX power supply included
- Three 5.25" and two 3.5" front bays
- 16.5" H x 8.25" W x 16.5" D
- Brand new in box, 90-day warranty

HSC# 80459 **$47.50**

Multimeter Specials!

- Model #AEEC-1890 DMM with extras!
- 3 1/2 Digit LCD
- Adjustable Flip-Up display for the easiest viewing ever!
- 0.5% basic accuracy, dual-slope integration A/D converter
- Measures AC/DC volts, Ohms, Current, Capacitance & hFE
- Ranges:
  1000VDC, 700VrmsAC, 200 ohm - 200 Megohm
  20 mA - 20A, 2nF - 20 uF, NPN/PNP hFE.
- Separate jacks for capacitors and transistors
- 'HOLD' function to capture measured peaks
- Yellow soft rubber cradle protects meter and prevents skids
- Brand New! - With Test Leads
- Compare at prices of $70, $80 and up!

HSC#80504 **$39.95**

- Inexpensive Digital Multimeter is packed with features!
- 0.5% Basic Accuracy, 19 scales, battery included!
- Ohms, Volts DC & AC, Milliamps DC & AC, 10 Amps DC
- Diode Tester, Transistor checker
- With test leads, instructions
- New, 30 day warranty

HSC#80370 **$14.95**

Holiday Gift Ideas!

LED Flashlights

- 3 styles to choose from, uses latest technology!
- Ultra-bright white LED's -- ultra-low power consumption!
- Keychain unit uses common Lithium 2032 cell (included)
- Visible up to one mile! 10-year shelf life on battery!

HSC# PML-1W **$19.95**

- Hand-held units use two AA batteries (not included)
- 1-LED model for battery life, and three-LED model for brightness, both have moisture-resistant construction

HSC# PLW-1 One-LED model **$14.95**

HSC# PLW-3 Three-LED model **$24.95**

Illuminated All-in-one tool

- Multiple changeable tips store in handle of screwdriver
- Built-in flashlight focuses beam on tool-tip
- Perfect for emergency repairs, even in the dark!

HSC# 80466 **$6.95**

Antistatic Mat

- Protect computers & delicate electronic equipment from damage due to static discharge!
- 24" x 28", includes grounding cable and cable minder

HSC# 18112 **$7.50**

Leather-look Laptop Carry Case

- Measures 12.5" x 10" x 2" (inside dimensions)
- Velcro-sealed outer pouch, padded shoulder strap with heavy-duty swivel hooks, zipper closure.
- Handsome black vinyl "leather-grain" exterior
- Cushiony plush interior protects your laptop's case

HSC#17662 **$17.50**

Laser-Diode pointer

- Brass keychain unit enclosed 5mW red laser diode
- Five interchangeable lenses provide variety of pattern
- Warning! This is not a toy, keep from children!

HSC# 80452 **$12.50**

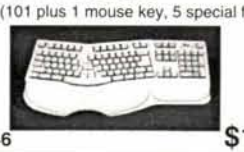
PCMCIA 28.8 Modem!

- Texas Instruments 'WinMax 34SP' 28.8 KBPS modem
- Driver software available from our website: http:www.halted.com/online
- Telco jack connector/adapter included
- New...in OEM pack -- 90 day warranty

HSC# 18066 **$19.95**

Ergonomic Keyboard!

- Mouse Systems "Contour 107" comfort keyboard!
- New in box with AT/PS2 adapter
- 107 keys, (101 plus 1 mouse key, 5 special function)



HSC# 18046 **$19.95**

PCI-Bus 56K Modem!

- Genica PCI-Bus 56K Modem at unheard-of price!
- Data, FAX, voice, full V.90 compatibility
- Voice from handset
- Windows 95/98 or NT only (Not Win 3.1 compatible)
- Uses latest Lucent chipset, comes with Lucent drivers
- New retail box, with expanded application software on CD
- 90-Day Warranty

HSC# 17532 **New! Lower Price!** **$29.95**

Visit HSC's Website!

- Pay us a virtual visit on the World Wide Web!
- Simply point your browser to *http://www.halted.com*
- Site is constantly being revised, please visit often!
- Or, you can email your order to *hscmail@halted.com*

HSC Catalog online!

- That's right, get HSC's catalog on the World-Wide Web!
- Simply go to www.halted.com and follow the big red link.
- Adobe .PDF files are available for download and viewing.
- Or drop on by and pick one up...we'd love to see you!

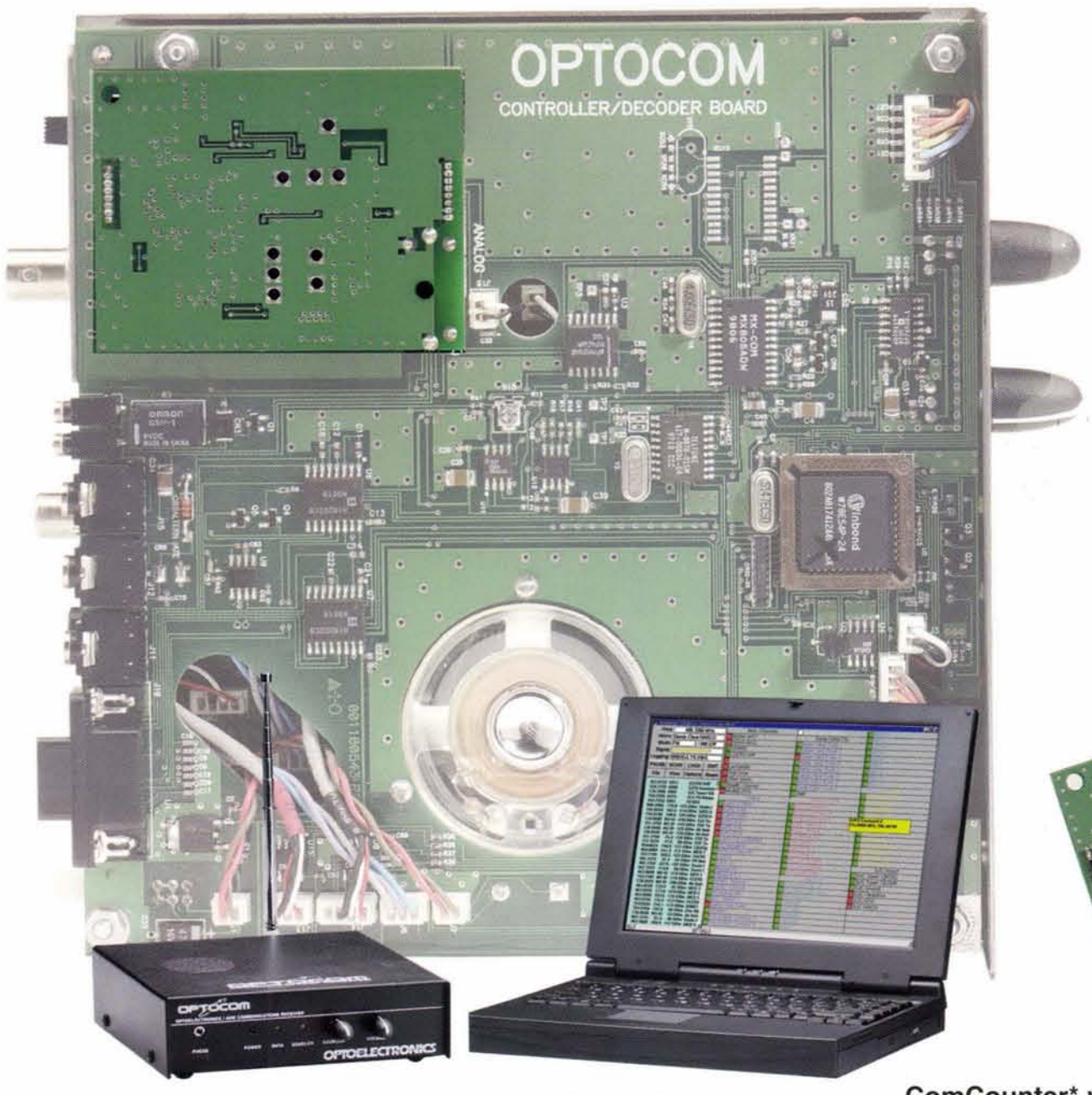
Halted specialties co. **HSC Electronic Supply**

Toll Free (Orders Only) 1-800-4 HALTED (1-800-442-5833)
Internet World Wide Web: *http://www.halted.com*
3500 Ryder St., Santa Clara, CA 95051 (408) 732-1573
4837 Amber Ln., Sacramento, CA 95841 (916) 338-2545
5681 Redwood Dr., Rohnert Park, CA 94928 (707) 585-7344

-or-

FAX your orders to:
(408) 732-6428

Terms: Some quantities limited; all items subject to prior sale. **Minimum order: $10.00 plus shipping.** Orders under $20.00 subject to $2.00 handling fee, in addition to shipping. All orders shipped FOB Santa Clara, CA (this means you pay freight!) by UPS Surface (no P.O. Boxes) unless otherwise specified, in which case prevailing carrier rate plus $5.00 handling fee applies. Prepaid orders that don't include shipping charges will be shipped freight COD. There is a $5.00 UPS charge added to shipping charges for COD shipments. If you have questions about your order, please call Customer Service at (408) 732-1854 M-F 9AM to 5PM PST.



Optocom
$499

ComCounter* with Software
$149

INSIDE ADVANTAGE

Another advantage to owning the Optocom PC controlled receiver. Take a look inside at the new ComCounter frequency counter board. Operating like a normal frequency counter the ComCounter will also Reaction Tune the Optocom to the frequency it captures. Using the supplied software the frequency along with CTCSS, DCS, LTR and DTMF may be displayed. **The Optocom, leading the way in computer control scanning.**

- Range 25-520, 760-1300 (Cellular Range Blocked)
- Triple Conversion Receiver
- Scan conventional frequencies at 50 Channels per sec.
- Trunk Track Motorola and LTR with supplied Trakkstar software
- Discriminator audio input and output
- Motorola/EDACS control channel trunk following with third party software
- Decodes CTCSS, DCS, LTR, and DTMF

- Built in Data Slicer
- Reaction Tune with the Scout
- High speed GRE receiver board
- Palm Pilot support for mobile use
- Supported by other third party software programs
- Store and Scan 100 frequencies for use away from the computer
- Internal Reaction Tune feature with optional ComCounter* installed

*ComCounter requires version 1.4 or better call for details

OPTODIRECT: 800-327-5912

OPTOELECTRONICS®

5821 NE 14th Avenue • Ft. Lauderdale, FL • 33334

Visa • MasterCard • C.O.D. • Prices and Specifications are subject to change without notice or obligation

Telephone: 954-771-2050 • **Fax:** 954-771-2052 • **Email:** sales@optoelectronics.com • **Internet:** www.optoelectronics.com

Motorola, EDACS, LTR, Trakkstar, Palm Pilot, Optoelectronics are all registered trademarks

Write in 154 on Reader Service Card.

BOTBASH '99 6
This yearly event held in Phoenix is an excellent venue for both those just starting out in robot combat events, and seasoned vets. *Dan Danknick*

USING LOW-COST MELODY AND SOUND-EFFECTS GENERATORS ICs 12
Create a festive holiday atmosphere with these melody ICs. And, with a wide variety of songs and sound effects to choose from, you can personalize gifts or cards. *Ray Marston*

ORBITAL E-MAIL — AN AFFORDABLE SOLUTION 43
Have access to E-Mail anywhere you go, with the help of Magellan's GSC-100 handheld and the Orbcomm satellite service. *Gordon West*

A SIMPLE CONTROLLER FOR STEPPER MOTORS TO USE WITH MICROPROCESSORS 50
Construct this controller for use with unipolar motors. It's perfect for use with microprocessors since it has just two control lines: one to control the stepping of the motor and the other to control the direction of the motor's rotation. *James Lyman*

A HEADSET JUNCTION BOX 87
Have the convenience of a headset on your computer without the inconvenience of having to constantly plug and unplug the speakers and microphone at the back of your computer. *Gerald Roylance*

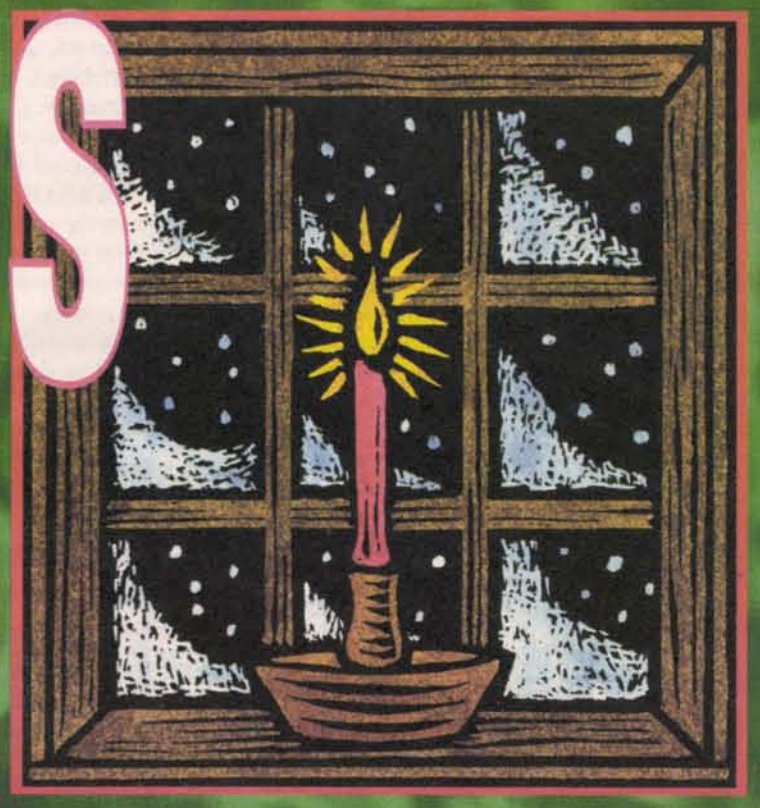
A+ CERTIFICATION — WHAT CAN IT DO FOR YOU? 90
You've probably heard of the A+ certification for computer technicians. But what can it do for you? Read on ... *Larry Ball*

VOLUME 20 • NO. 12
DECEMBER 1999

NUTS & VOLTS MAGAZINE (ISSN 1065-2035) IS PUBLISHED MONTHLY FOR $19.00 PER YEAR BY T&L PUBLICATIONS, INC., 430 PRINCELAND COURT, CORONA, CA 92879. APPLICATION TO MAIL AT PERIODICALS POSTAGE RATES IS PENDING AT CORONA, CA AND AT ADDITIONAL MAILING OFFICES. POSTMASTER: SEND ADDRESS CHANGES TO NUTS & VOLTS MAGAZINE, 430 PRINCELAND COURT, CORONA, CA 92879-1300.

Check out Santa's Special on Page 49 and our Winter Special on Page 48

Contents



Columns

AMATEUR ROBOTICS NOTEBOOK 62
Bit-level routines that make the master pay attention to what the slave is doing, a nifty new PWM part, and some suggestions for good winter reading. *Robert Nansel*

COMPUTER-CONTROLLED WORLD 8
Advanced RS-232 Control of Relays: January will mark the release of the largest and most powerful relay controller yet, and begin a whole new way of thinking. *Ryan Sheldon*

ELECTRONICS Q & A *TJ Byers* 26

OPEN CHANNEL 22
Electrostatic discharge (ESD). *Joe Carr*

STAMP APPLICATIONS 73
STAMP Net: A multi-drop Stamp-based network — Part 2. *Lon Glazner*

Classified Ad Index

10. Ham Gear for Sale....34
20. Ham Gear Wanted....34
30. CB/Scanners....34
40. Music & Accessories....0
50. Computer Hardware....35
60. Computer Software....36
70. Computer Equip. Wanted....36
80. Test Equipment....37
85. Security....38
90. Satellite Equipment....40
95. Military Surplus Electronics....0
100. Audio/Video/Laser....41
110. Cable TV....41
115. Telephone/Fax....56
120. Components....56
125. Microcontrollers....57
130. Antique Electronics....57
135. Aviation Electronics....0
140. Publications....57
145. Robotics....58
150. Plans/Kits/Schematics....58
155. Manuals/Schematics Wanted....58
160. Misc. Electronics For Sale....58
170. Misc. Electronics Wanted....60
175. BBS & Online Services....60
180. Education....61
190. Business Opportunities....61
200. Repairs/Services....61

Departments

Advertiser's Index ... 78
Classified Ad Info ... 78
Dealer Directory ... 77
Events Calendar ... 18
New Product News ... 93
News Bytes ... 11
NV AdMart ... 68-70
NV Bookstore ... 48
Prize Drawing ... 49
Reader Feedback .. 11
Tech Forum ... 80

Published Monthly By
T & L Publications, Inc.
430 Princeland Court
Corona, CA 92879-1300
(909) 371-8497
FAX (909) 371-3052

E-Mail — editor@nutsvolts.com
URL — http://www.nutsvolts.com

Subscription Order ONLY Line
1-800-783-4624

PUBLISHER
Jack Lemieux *N6ZTD*

EDITOR
Larry Lemieux *KD6UWV*

MANAGING EDITOR
Robin Lemieux *KD6UWS*

ON-THE-ROAD EXHIBIT COORDINATOR
Audrey Lemieux *N6VXW*

SUBSCRIPTIONS
Abby Madain

CLASSIFIED ADS
Natalie Sigafus

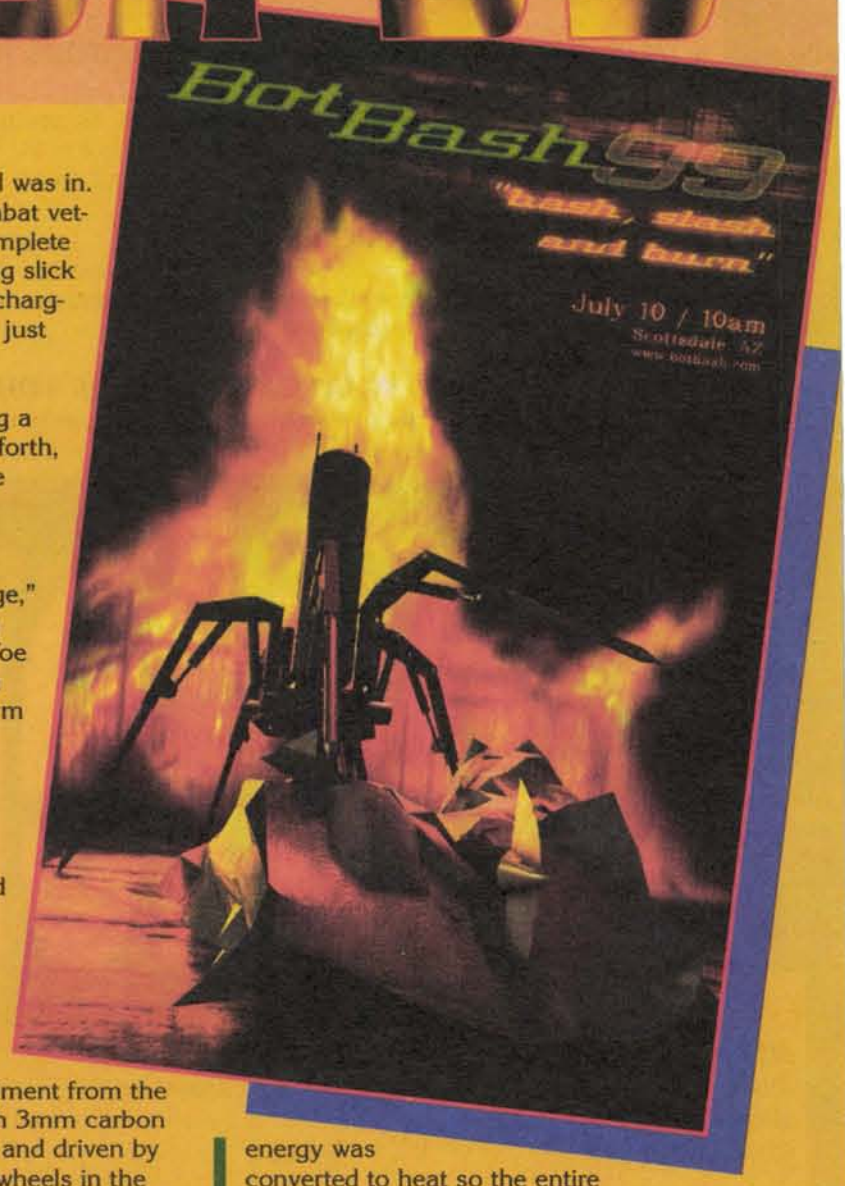
DISPLAY ADS
Mary Gamar

Copyright 1999
by
T & L Publications, Inc.
All Rights Reserved

All advertising is subject to publisher's approval. We are not responsible for mistakes, misprints, or typographical errors. Nuts & Volts Magazine assumes no responsibility for the availability or condition of advertised items or for the honesty of the advertiser. The publisher makes no claims for the legality of any item advertised in Nuts & Volts. This is the sole responsibility of the advertiser. Advertisers and their agencies agree to indemnify and protect the publisher from any and all claims, action, or expense arising from advertising placed in Nuts & Volts. Please send all subscription orders, correspondence, UPS, overnight mail, and artwork to: 430 Princeland Court, Corona, CA 92879.

by Dan Danknick

BotBash'99



After welding and machining until 2 a.m. every night of the preceding week, 6 a.m. sure did come early on Friday. Mike Regan had just arrived at my shop, his 25 kg robot "Deathtrap" in tow, along with tools and spare parts. Thirty minutes later, we were clipping along at 75 mph, sipping coffee and on our way eastward to Phoenix, 420 miles away. We were robot builders and off to BotBash'99 where we hoped to inflict more radio-controlled damage than we received.

Neither of us were veterans of this annual competition; Mike won the 12.5 kg robot class last year while I was an event judge. This year, nothing was going to keep me out of competing, unless it was another ruthless monsoon system sweeping through the area. But on top of it all — a new arena had been built! It was better, stronger, faster.

Unfortunately, it was on a truck about 100 yards away from the plaza in which the event would be held. And, being a Friday, most members of the sponsoring robot club, PAReX, were still at work. As Mike and I joined in the move and set-up party in the 104-degree heat, I wondered if this was just a clever scheme by the other competitors to wear us down for the robot battles tomorrow.

The BotBash website lists a simple purpose, "To provide a most excellent event for robotic warriors and enthusiast to get together and get some!" On Saturday morning as my fellow competitors began uncrating their teleoperated machines of mayhem, I realized just how much trouble I was in. Christian Carlberg, a robot combat veteran, fielded "Toe Crusher," complete with purple anodizing and racing slick tires off a go-cart. "My battery chargers have a special chip in them just for these Hawker batteries" he explained, smiling. Powered by wheelchair motors and swinging a hardened steel spike back and forth, it could easily chip the concrete floor with a reactionary blow.

On the other end of the pit area, local engineer Chris Harriman rolled in with "Carnage," a black open-frame design with knobby wheels not too unlike Toe Crusher. Except Carnage had a 10 lb. axe head on a 36 inch arm that could be whipped around left and right. The axe worked pretty well on "Saber" much to the amazement of Tony Buchignani, a lawyer from Los Angeles. "That axe just crushed my aluminum frame. It just barely missed my power controller!"

Fortunately, I was in the next lower weight class with a 12.5 kg robot I had named "Venus Probe." It was an experiment from the start, a steel frame covered with 3mm carbon fiber and driven by two wheels in the back. Most feared in my class was "Dr. Inferno," a reanimated Tomy Omnibot by the sinister hand of graduate student Jason Bardis. Gone were the Omnibot's plastic arms, in their place hung cordless drill motors, one with a 12" auger bit and the other a hole saw. And the eyes still glowed red.

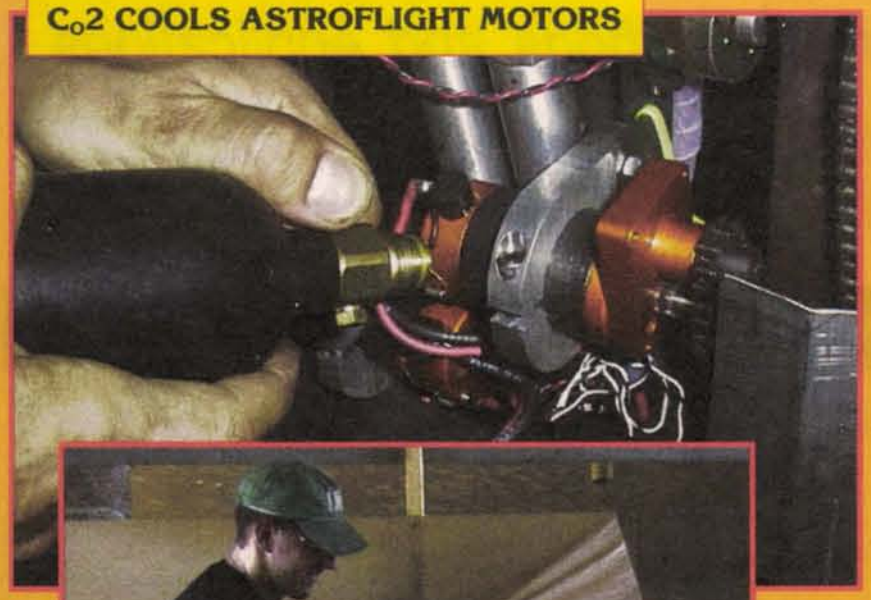
Back in the 25 kg class, my friend Mike had just taken his robot off the circulating fan. Mike was using two Astroflight motors, one for each side of his drive system. Super high performance brushed DC with rare earth magnets, they could each put out 1/2 of a horsepower and were draining 7Ah gel cells in four minutes. All of this energy was converted to heat so the entire robot frame had to be force-cooled between matches to keep everything from melting. In the end, Mike took home the trophy after fighting Carnage for the title. They say you just can't beat a lot of steel and that proved correct when that axehead kept throwing sparks off Deathtrap's frame. And Deathtrap kept on coming in for the kill.

As for me, I managed to squeak out a win by one point in my class. Cleverly, the competition rewards not only one-on-one fighting but a sumo-style pushing competition and driving through a timed obstacle course. Good thing I had spent time learning to drive my robot.

BotBash is a yearly event and if you're within driving distance of Phoenix, it's well worth your weekend. It's an excellent venue for those just starting out in robot combat events: low stress but a lot of seasoned builders to ask questions of. And hey, you can take me on in the 25 kg class come 2000. NV

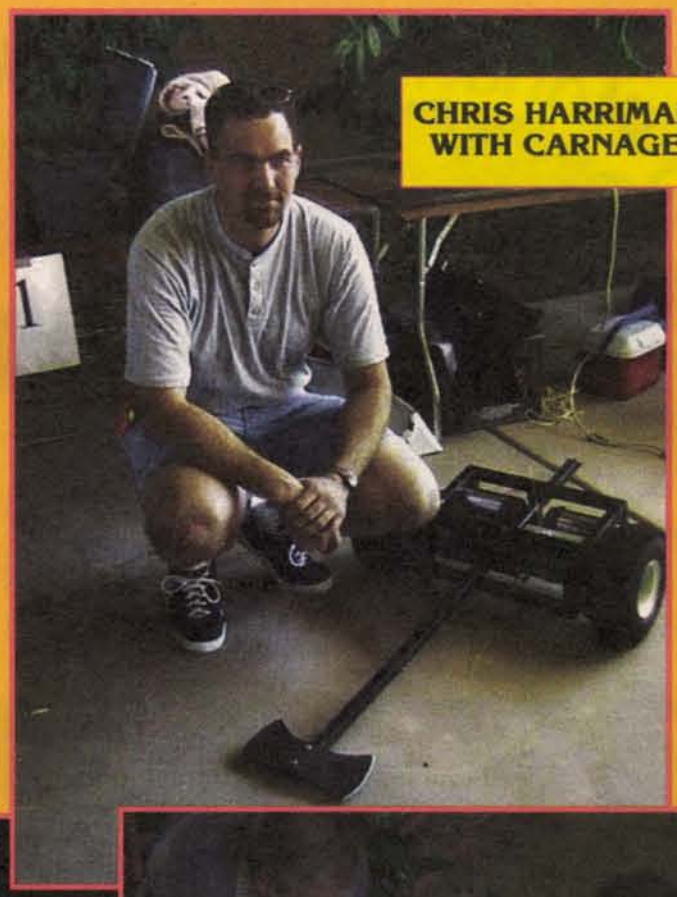
BotBash info is updated at www.botbash.com. Hawker batteries info at www.hepi.com. Astroflight motor info and prices at www.astroflight.com. The author can be reached at dan@teamdelta.com.

Coming next month ... MECHADON

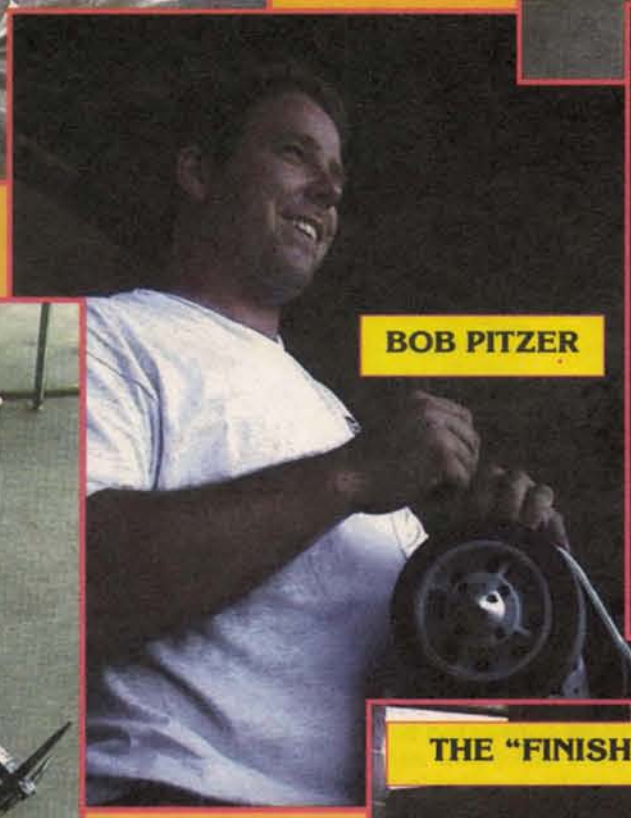


C_o2 COOLS ASTROFLIGHT MOTORS

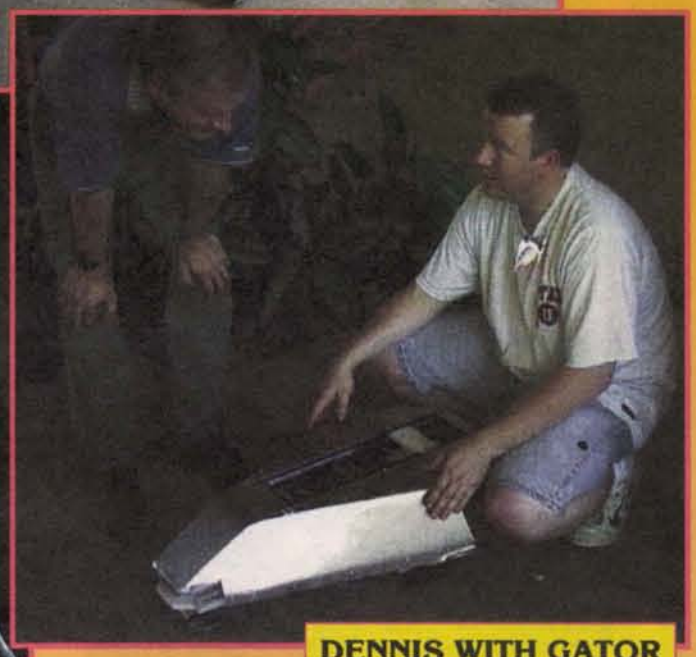
BUILDING THE ARENA



CHRIS HARRIMAN WITH CARNAGE

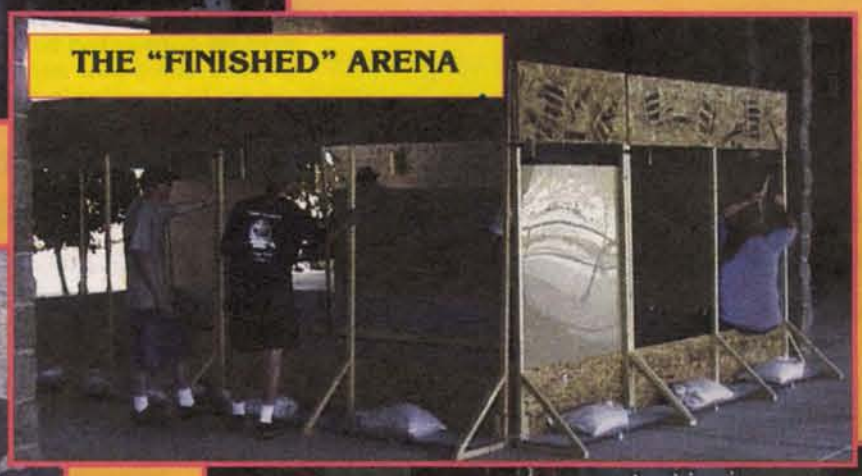


BOB PITZER



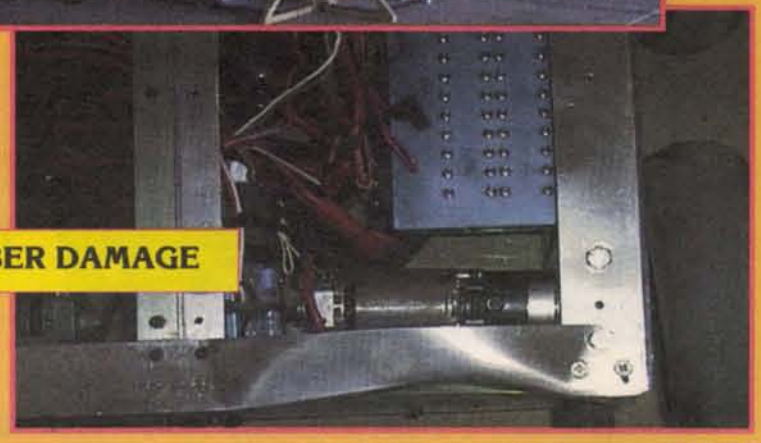
DENNIS WITH GATOR

TOE CRUSHER



THE "FINISHED" ARENA

DEATHTRAP



SABER DAMAGE

Advanced RS-232 Control of Relays

by Ryan Sheldon, National Control Devices • (417) 646-5644 • www.controlanything.com

Here's a preview of what you can expect in 2000. We'll start with the R16 relay controller coming out in January. It is the largest and most powerful one so far.

Over the past couple of years, I have spent a lot of time talking to readers. It's my job to get to know what you want, and balance that with what I can provide. But sometimes, I have to go out on a limb and do things the way I want to, experiment a little, and see if I can come up with something that you can use.

When I am designing a new product, I try to keep in mind what you have said. I keep mental lists of all the good ideas that you have given me and mix that up with my own ideas. It has changed the way I look at my hobby of computer control, and it has subsequently changed the way I develop products to help you.

In January, I will be releasing my R16 relay controller. Put simply, it is a marriage of your ideas and mine, packaged in the form of an experimental product that represents what I have learned. The R16 is not simply another device. In my mind, it represents a new way of thinking.

Our next generation of computer control devices will be released throughout the year of 2000, beginning with our January release of our R16 16-relay controller. For those of you unfamiliar with relays, a relay is simply a switch. Our relay controller allows a computer to control a bank of 16 relays. Up to 256 relay controllers can share a single serial port, allowing your computer or BASIC Stamp to control up to 4,096 relays from a single RS-232 output.

While it is not the first relay controller we have released, it is the largest and most powerful one, foreshadowing the way our devices will work in the future. Like our original 16-device network, all new devices will work together, allowing you to control various displays, relay controllers, and many other upcoming devices (up to 256) using a simple two-wire interface and a powerful command set that eliminates hours of work. This article serves a real-world preview of what you can expect in 2000.

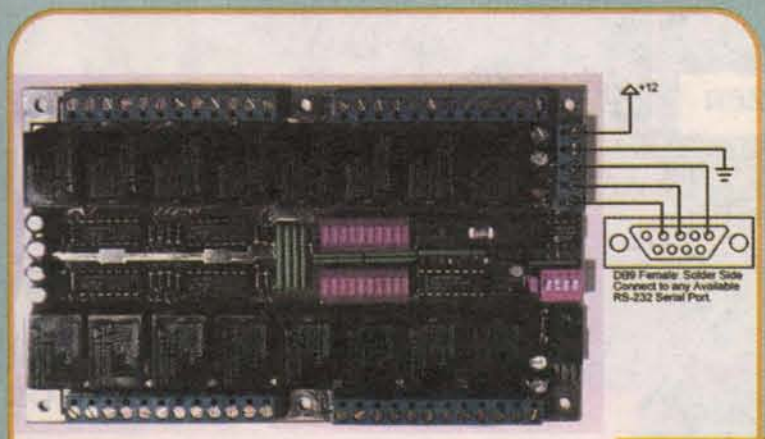


Figure 2: The R16 relay controller can also be connected to the RS-232 port of your computer using a DB9 female connector available from your local RadioShack.

Connection

The R16 relay controller is easily connected to the serial port of your computer or microcontroller. Figure 1 illustrates the connection of the R16 to the BASIC Stamp II SX. Figure 2 illustrates the connection of the R16 to the serial port of your computer.

Configuration

Once connected, simply set the four dip switches to configure the relay controller for your installation. In test mode, each relay is activated in sequence, then deactivated. Once the test cycle has completed, the board is ready to accept data at 9600 baud.

1	2	3	
Off	Off	Off	Test Mode, 9600
On	Off	Off	2400 Baud
Off	On	Off	4800 Baud
On	On	Off	9600 Baud
Off	Off	On	19.2K Baud
On	Off	On	38.4K Baud
Off	On	On	57.6K Baud
On	On	On	115.2K Baud

Dip switch 4 controls the mapping of relays 9-16. If this switch is set to the OFF position, then relays are numbered in the pattern shown in Figure 3, otherwise the relays are numbered in the pattern shown in Figure 4.

"The R16 is not simply another device. In my mind, it represents a new way of thinking."

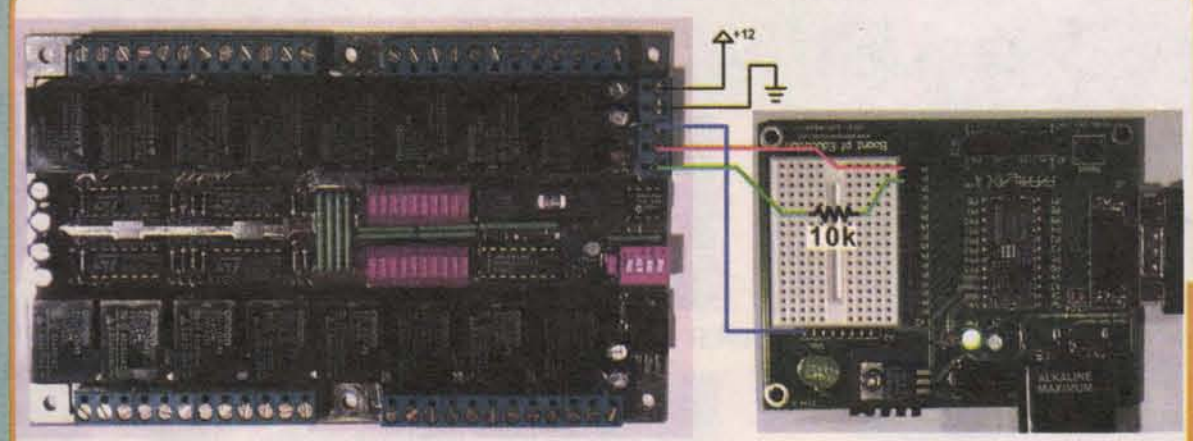


Figure 1: The prototype of the R16 relay controller is easily connected to Parallax's BASIC Stamp. The Board of Education is used as a carrier board for the BASIC Stamp II SX providing convenient connection to the relay controller.

Communication

The way you speak to a device determines how easy the device is to use. It was our goal to minimize the amount of programming you have to do to control our devices. Starting this year, we are making it easier than ever to control all of our devices by introducing a simple ASCII-based command set. Commands to all devices must begin by sending ASCII character code 254. Once received, the device will enter command mode. In the case of the relay driver, the next ASCII character code that is received can trigger a relay or issue other commands for advanced functions. Figure 5 illustrates example source code for controlling the R16 using the BASIC Stamp II SX.

It is also possible to ask the relay controller what the current status is of any or all relays. Figure 6 illustrates example source code for asking the relay controller the status of individual relays.

It is also possible to control the R16 from Visual Basic. Figure 7 illustrates a program that is currently under development for providing a complete GUI for the R16. Advanced functions include macro commands for enabling and disabling banks of relays and setting the device number. The R16 is also capable of memorizing the on/off status of all 16 relays into 256 memory banks. Using a simple memory recall command, the relays are instantly activated and deactivated in the stored pattern.

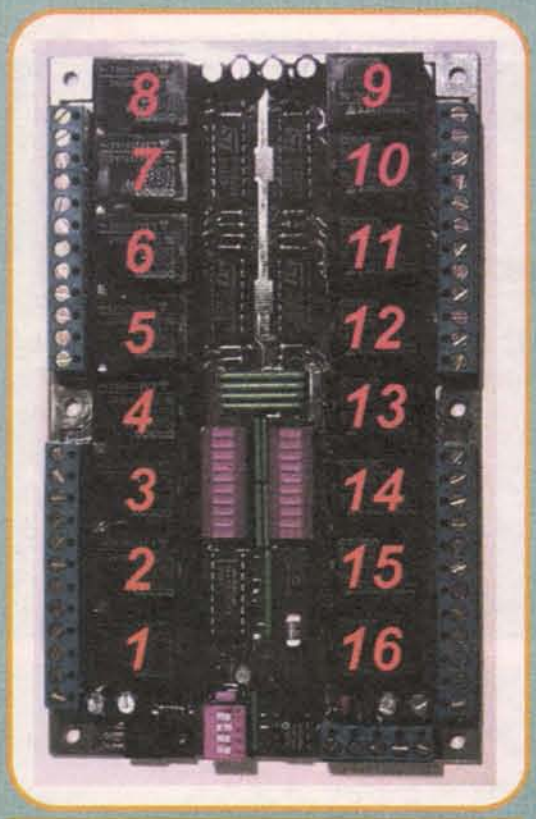


Figure 3: When the MAP dip switch is set in the OFF position, relays are numbered as shown above.

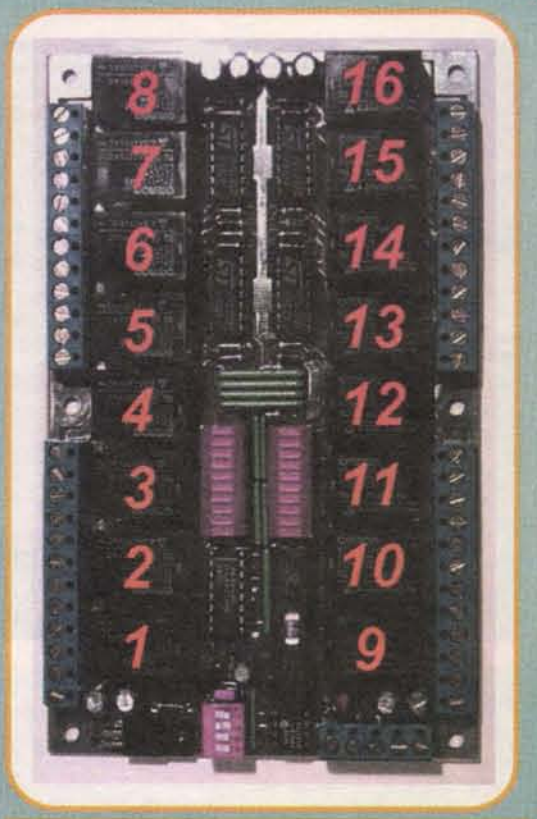


Figure 4: When the MAP dip switch is set in the ON position, relays are numbered as shown above.

Command Set

The R16 has many commands to simplify the control of relays. To send a command to the R16, you must first send ASCII character code 254, then the command number. Some commands have parameters. In this case, send ASCII character codes (with a numeric value of 0 to 255). The following list provides a brief description of the R16 command set.

0 Turn Off Relay 1
1 Turn Off Relay 2
2 Turn Off Relay 3
3 Turn Off Relay 4
4 Turn Off Relay 5
5 Turn Off Relay 6
6 Turn Off Relay 7
7 Turn Off Relay 8
8 Turn Off Relay 9
9 Turn Off Relay 10
10 Turn Off Relay 11
11 Turn Off Relay 12
12 Turn Off Relay 13
13 Turn Off Relay 14
14 Turn Off Relay 15
15 Turn Off Relay 16

Figure 5: The BASIC Stamp II SX is used to generate the control codes for the R16 relay controller. Relays will be turned off and on in sequence as shown in the program.

BASIC Stamp - C:\WINDOWS\Desktop\NV Dec 99\Rel...

File Edit Run Help

0:RelayOnOff.bsx

```
'Basic Stamp II SX Source Code to Turn Relays
'Off and On.  Set Baud Rate on Board to 38.4
'for FAST Operation.  Output Pin P0 connects
'Directly to the RS-232 input of the Relay
'board.  Connect the Ground of the Stamp to
'the RS-232 Ground on the Relay Board.

SerOut 0, 16429,[254, 0]   'Turn Relay 1 Off
SerOut 0, 16429,[254, 1]   'Turn Relay 2 Off
SerOut 0, 16429,[254, 2]   'Turn Relay 3 Off
SerOut 0, 16429,[254, 3]   'Turn Relay 4 Off
SerOut 0, 16429,[254, 4]   'Turn Relay 5 Off
SerOut 0, 16429,[254, 5]   'Turn Relay 6 Off
SerOut 0, 16429,[254, 6]   'Turn Relay 7 Off
SerOut 0, 16429,[254, 7]   'Turn Relay 8 Off
SerOut 0, 16429,[254, 8]   'Turn Relay 9 Off
SerOut 0, 16429,[254, 9]   'Turn Relay 10 Off
SerOut 0, 16429,[254, 10]  'Turn Relay 11 Off
SerOut 0, 16429,[254, 11]  'Turn Relay 12 Off
SerOut 0, 16429,[254, 12]  'Turn Relay 13 Off
SerOut 0, 16429,[254, 13]  'Turn Relay 14 Off
SerOut 0, 16429,[254, 14]  'Turn Relay 15 Off
SerOut 0, 16429,[254, 15]  'Turn Relay 16 Off

SerOut 0, 16429,[254, 16]  'Turn Relay 1 On
SerOut 0, 16429,[254, 17]  'Turn Relay 2 On
SerOut 0, 16429,[254, 18]  'Turn Relay 3 On
SerOut 0, 16429,[254, 19]  'Turn Relay 4 On
SerOut 0, 16429,[254, 20]  'Turn Relay 5 On
SerOut 0, 16429,[254, 21]  'Turn Relay 6 On
SerOut 0, 16429,[254, 22]  'Turn Relay 7 On
SerOut 0, 16429,[254, 23]  'Turn Relay 8 On
SerOut 0, 16429,[254, 24]  'Turn Relay 9 On
SerOut 0, 16429,[254, 25]  'Turn Relay 10 On
SerOut 0, 16429,[254, 26]  'Turn Relay 11 On
SerOut 0, 16429,[254, 27]  'Turn Relay 12 On
SerOut 0, 16429,[254, 28]  'Turn Relay 13 On
SerOut 0, 16429,[254, 29]  'Turn Relay 14 On
SerOut 0, 16429,[254, 30]  'Turn Relay 15 On
SerOut 0, 16429,[254, 31]  'Turn Relay 16 On
```

1: 1

Figure 6: Ask the R16 for the current status of each relay. It is also possible to ask the R16 what the status is of each bank of relays (returning a byte) or ask for the status of both banks (returning two bytes).

BASIC Stamp - C:\WINDOWS\Desktop\NV Dec 99\RelayFun2.BS2

File Edit Run Help

RelayFun2.BS2

```
'Basic Stamp II SX Source Code for Getting the Status of Relays.  Set Baud
'Rate on Board to 38.4 for FAST Operation.  Output Pin P0 connects
'Directly to the RS-232 Input of the Relay Board.  Connect the Ground of
'the Stamp to the RS-232 Ground on the Relay Board.  Connect Pin P1 of
'the Stamp to the RS-232 Output on the Relay Board.

Status      var   Byte  'Stores the Status of an Individual Relay

SerOut 0, 16429,[254, 43, 0] 'Send Command to Get the Status of Relay 1
Gosub Report 'Display the Status on the Terminal Window

SerOut 0, 16429,[254, 43, 7] 'Send Command to Get the Status of Relay 8
Gosub Report 'Display the Status on the Terminal Window

SerOut 0, 16429,[254, 43, 11] 'Send Command to Get the Status of Relay 12
Gosub Report 'Display the Status on the Terminal Window

SerOut 0, 16429,[254, 43, 15] 'Send Command to Get the Status of Relay 16
Gosub Report 'Display the Status on the Terminal Window


Report:
    SerIn 1, 16429,100,Timeout,[Status]
    Debug ? Status
    Timeout:
Return
```

1: 20

Figure 7

16 Turn On Relay 1
17 Turn On Relay 2
18 Turn On Relay 3
19 Turn On Relay 4
20 Turn On Relay 5
21 Turn On Relay 6
22 Turn On Relay 7
23 Turn On Relay 8
24 Turn On Relay 9
25 Turn On Relay 10
26 Turn On Relay 11
27 Turn On Relay 12
28 Turn On Relay 13
29 Turn On Relay 14
30 Turn On Relay 15
31 Turn On Relay 16

It is also possible to set the status of all relays or groups of relays simultaneously. Relays are divided into two groups called "Banks." The left bank of eight relays can be controlled independently from the right bank of eight relays, allowing you to send commands to speak to each bank individually, or both banks simultaneously. A "Pattern" parameter of 0 to 255 is sent to control the status of eight relays simultaneously. A value of 0 turns off all relays, while a value of 255 turns all relays on. Any value in between turns off relays in the equivalent binary pattern. Relays are updated as soon as all parameters are received.

32 Set Left Bank Relays
0-255 Pattern
33 Set Right Bank Relays
0-255 Pattern
34 Set Status of All Relays
0-255 Left Bank Pattern
0-255 Right Bank Pattern

The following commands are used to control the status of all relays simultaneously:

35 Turn Left Bank Relays Off
36 Turn Left Bank Relays On
37 Turn Right Bank Relays Off
38 Turn Right Bank Relays On
39 Turn All Relays Off
40 Turn All Relays On
41 Disable Relay Bank — All Relays Disabled, relays will all be turned off
42 Enable Relay Bank — All Relays Enabled, relays are capable of activation, but not necessarily on

It is also possible to ask the R16 what relays are currently activated. The following commands return a byte of data (except where noted) indicating the on/off status of individual or all relays.

43 Get Relay Status
0-15 for individual status
16 for status of Left Bank
17 for status of Right Bank
18 for status of Both Banks (Returns 2 Bytes)

We also added a unique memory function for storing and retrieving relay patterns. Imagine you have some relays on and some off. It is possible to store this pattern in one of 256 memory banks. It is very easy to recall these relay patterns using only a few simple commands.

44 Store Status of Relays
0-255 Memory Bank
45 Recall and Set Status of Relays
0-255 Memory Bank
46 Store Current Status of Relays as Power-up Default
47 Clear Power-up Default Status so Relays do not actuate on Powerup

The R16 can acknowledge the receipt of ASCII commands by returning ASCII character code 85 every time a command has finished execution. By default, the R16 does NOT reply after every command, making it respond faster to incoming ASCII characters.

48 Reporting Mode: ASCII 85 is returned to the computer for confirmation, slower communication
49 Non-Reporting: FAST but no confirmation of relay activation
50 Store Reporting Settings

Networking Command Set

It is possible to attach up to 256 R16 relay controllers to a single serial port and control each one individually or several simultaneously. Each device is assigned a device number, stored in non-volatile EEPROM memory. Simply send commands to enable and disable individual devices and store/recall the device number. The following list of commands is used for controlling 256 R16 relay controllers from a single serial port.

246 Store Device Number
0-255 Device Number

247 Retrieve Device Number
Device will reply with 0-255

248 Enable All Devices

249 Disable All Devices

250 Enable a Selected Device
0-255 Device to Enable

251 Disable a Selected Device
0-255 Device to Disable

252 Enable Selected Device Only, Disable Others
0-255 Device to Enable

253 Disable Selected Device Only, Others Enabled
0-255 Device to Disable NV

NEW CONTACT INFO:
Ryan Sheldon
National Control Devices
P.O. Box 455
Osceola, MO 64776
Phone: (417) 646-5644
FAX: (417) 646-8302
ncdryan@aol.com
www.controlanything.com

National Control Devices
P.O. Box 455
Osceola, MO 64776
Phone: (417) 646-5644
FAX: (417) 646-8302
www.controleverything.com
ncdryan@aol.com

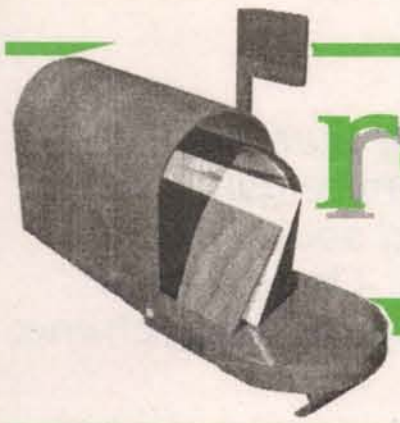
SOURCES:
BASIC Stamp II SX, Board of Education
Parallax, Inc.
3805 Atherton Road, #102
Rocklin, CA 95765
Phone: (888) 512-1024
FAX: (916) 624-8003
www.parallaxinc.com
info@parallaxinc.com

ASEL Video Switcher, R85 Relay Controller, VF Display/Controller

Special Pricing for *Nuts & Volts* Subscribers:

I would also like to encourage first-time readers to subscribe to *Nuts & Volts* magazine. Last month, we introduced our 10-piece pricing for *Nuts & Volts* readers. Your response was so overwhelming that we decided to offer this pricing plan permanently. We are offering special prices to *Nuts & Volts* subscribers, which can easily save you the cost of the subscription in just a couple of months. We are also offering a FREE upgrade to UPS two-day delivery (domestic shipment only) with a valid subscriber number.

Here's how it works: Subscribe to *Nuts & Volts* magazine. On your *Nuts & Volts* mailing label, you will find a subscriber number. Call us with your order and current subscriber number and receive ANY NCD device at the 10-piece price. *LIMIT ONE DEVICE PER SUBSCRIBER PER MONTH*. Don't let your subscription lapse, because the savings are ONLY valid as long as you are a *Nuts & Volts* subscriber.



reader FeedBack

Dear Nuts & Volts:

Just a note to congratulate you on the series of CNC articles featured in *Nuts & Volts* this year. They are the most interesting, informative, and well-presented articles I have ever read in an electronics magazine since 1968. Thanks for the information and efforts you have put into these articles.

Wolfgang Maier/ Australia

Dear Nuts & Volts:

Your magazine is responsible for something wonderful: An article explaining how to build a Tesla coil ran in your Sept. '99 issue by Walt Noon. In a world of hi-tech items such as cell phones, computers, etc., —that are constantly getting smaller and faster — a Tesla coil almost seems primitive.

The beauty of it though is in its simplicity. I'm very grateful that you do what you do. And also grateful for awakening an old interest for me, the hobby of building kits. Thank you!

Frank Gutierrez/Kingsville, TX

Dear Nuts & Volts:

I happened to see the Sept. '99 issue in Barnes & Noble today. I was hooked. And I loved the article on the Tesla coil! I happened to see more info in than I have seen or read in any other articles. What an informed piece of work!

Vince Adams
Internet

JFETS

ULTRA LOW NOISE
LS843 - 3nV/Hz typ

TIGHT MATCHING
LS843 - 1 mV max

- N & P Channel
- Duals & Singles
- Custom Screening
- Die, SMT, Thru-Hole
- No Order Minimum
- COD's Accepted

Second Source for Domestic & Foreign JFETs & Bipolars

Full Service U.S. Manufacturer of Specialty Linear Products

LINEAR SYSTEMS

4042 Clipper Court
Fremont, CA 94538
510/490-9160/510/353-0261(Fax)
E-mail: 36236714@MCIMAIL.COM

Write in 193 on Reader Service Card.

Newsbytes

HIFI.COM TO OFFER FREE DVD PLAYERS TO KICK OFF HOLIDAY ONLINE SHOPPING SEASON

While supplies last, when consumers purchase any complete Dolby Surround® system from Hifi.com they will receive a brand name DVD player absolutely free — a precedent setting offer from a consumer electronics e-tailer. Dolby Surround systems, providing everything the online shopper needs for top-notch home entertainment in any room in the house, start at $299.99. The package also includes coupons for 21 free DVD rentals and five free DVDs, with free shipping. First time buyers who purchase $100.00 worth of merchandise will also receive a $25.00 registration credit with their first purchase.

In addition to the free DVD player promotion, there are a number of other merchandise specials at Hifi.com this holiday season: A) When consumers purchase a complete stereo system valued at $499.99 or more, they receive a free model 88 table radio by Henry Kloss. B) A Kodak DC215 digital still camera for $324.95 ($299.99 after $25.00 merchandise credit).

"The Grinch stole last year's e-Christmas for many consumers with the lack of post-sale customer support from e-tailers in all markets," says Michael Sullivan, president of Hifi.com "We are dedicated to helping our customers every step of the way in purchasing the ideal home entertainment system for their needs — from online product selection and free shipping to hook-up and installation advice. Keeping our call center open on Christmas day to assist families in the hook-up and assembly of their purchases shows our dedication to our customer service."

For more information, contact: Mullen, Cameron Smith 978-468-1155, E-Mail: csmith@mullen.com

•

ADD HOLIDAY CHEER TO YOUR SCREEN WITH TWINKLE BULBS

Barefoot Productions releases Twinkle Bulbs V. 3.5, an enjoyable Windows 95/98/NT utility that lets you hang a string of virtual blinking colored holiday lights at the top of (or around) your screen, and add festive holiday music, wallpaper, and screen savers to your computer.

Twinkle Bulbs has more than 120 bulb sets, backgrounds, and music files to add holiday cheer at Christmas, Easter, St. Patrick's

Continued on page 85

Check out our Winter Special on page 48

The RF Connection
213 North Frederick Ave.
Suite 11NV
Gaithersburg, MD USA
20877

http://www.therfc.com/

Complete Selection of MIL-Spec Coax, RF Connectors and Relays

UG-21B/U N Male for RG-213/214.....$5.00
UG-21D/U N Male for RG-213/214.....$3.25

N Connectors for 9913/Flexi4XL/9096

UG-21B/9913.....$6.00 Pins Only.....$1.50
UG-21D/9913.....$4.00 Extra Gasket.....75

Amphenol 83-1SP-1050 PL-259.....$0.90
UG-176/U Reducer RG-59/8X. .25 or 5/$1.00
UG-175/U Reducer RG-58/58A .25 or 5/$1.00
Silver Teflon PL-259/Gold Pin.....$1.00 or 10/$9.00

MIL-Spec Coax Available (Teflon, PVC IIA)

New Product: Belden 9913F. 9913 with High Density PE Foam dielectric, stranded center cond. and Duobond III Jacket.....80/ft or $76.00/100ft

Also New: 9092, RG8X with Type II Jacket
Intro Price.....$23.00/100ft

Call for Specials of the Month

Full Line of Audio Connectors for Icom, Kenwood, and Yaesu

8 Pin Mike Female.....$2.50
8 Pin Mike Male Panel.....$2.50
13 Pin DIN for Kenwood.....$2.75
8 Pin DIN for Icom.....$1.00
8 Pin DIN for Kenwood.....$1.50

Prices Do Not Include Shipping

Orders 800/783-2666
Info 301/840-5477
FAX 301/869-3680

Write in 196 on Reader Service Card.

PICmicros & BASIC

PicBasic Compiler - $99.95
PicBasic Pro Compiler - $249.95

Now it's even easier to program the fast and powerful Microchip PICmicros. The PicBasic and PicBasic Pro Compilers convert your English-like BASIC programs to files that can be put directly into a PICmicro. True compilers for faster, longer programs. BASIC Stamp™ I/II* libraries. For mid-range PIC12C67x, 14Cxxx, 16C55x, 6xx, 7xx, 8x, 87x, 9xx and high-end 17Cxxx (PicBasic Pro only).

*BASIC Stamp is a registered trademark of Parallax Inc.

New! PIC-X1 Experimenter/ Lab Board

Assembled - $199.95
Kit with parts - $139.95
Bare PCB only - $49.95

EPIC Plus PIC Programmer - $59.95

Programs PIC12C5xx, 67x, 14Cxxx, 16C505, 55x, 6xx, 7xx, 8x, 87x and 9xx. Optional ZIF adapters for DIP, SOIC, MQFP, PLCC. Runs off two 9-volt batts or optional AC adapter. Includes programming software and assembler.

PICProto Prototyping Boards

Get it wired quicker! High-quality blank prototyping boards for PICmicros. Holds PICmicro, 5V reg, caps, oscillator, DB9-25, large proto area. $8.95 - $19.95

microEngineering Labs, Inc.
Box 7532 Colorado Springs CO 80933
(719) 520-5323 (719) 520-1867 fax
http://www.melabs.com

Write in 195 on Reader Service Card.

HOLIDAY PROJECT

by Ray Marston

Create your very own festive holiday atmosphere using these melody ICs. Add sound effects to gifts or cards. Or give your doorbell a special holiday chime.

USING LOW-COST 'MELODY' AND 'SOUND-EFFECTS' GENERATOR ICs

This special 'basic usage data' article looks at various low-cost melody generator and sound-effects generator ICs and circuits that are particularly useful in simple 'entertainment' or 'fun' applications.

All of these ICs are pseudo-linear types that contain digital elements such as clock generators and ROM-controlled counter/dividers and tone/noise generators, but are configured to generate analog-type output waveforms.

Note that most ICs of the various major types described in this article are manufactured in a wide variety of sub-types (which each generate specific sounds or tunes) that are intended mainly for use by bulk-purchasing commercial users, and that relatively few of these sub-types are available in one-off quantities, from a few specialist suppliers. All of the ICs used by the author were obtained directly from the manufacturers or from **Maplin Electronics**, P.O. Box 777, Rayleigh, Essex, SS6 8LU, in the UK.

MELODY GENERATOR IC CIRCUITS

Melody generator ICs are sophisticated but inexpensive and easy-to-use low-fi 'tune player' devices, usually housed in three-pin T0-92 packages that are each capable of playing a simple (up to 64 or 128 notes) melody. They are often used as basic tune generators in greeting cards or gifts, in toys and games, and in telephones and various other electronic gadgets. The three most popular ranges of melody generator ICs are the UM66T series from *UMC*, the M66T series from *Micro-E*, and the HT381xx series from *Holtek*; the rest of this section presents practical usage information on ICs from these three particular ranges.

The UM66T series (UMC)

Figure 1 shows basic details of the UM66T melody generator IC, which is housed in a three-pin TO-92 package, can be powered from a 1.3V to 3.3V battery supply, consumes a quiescent current of less than 1µA, and can play a tune of up to 64 notes (determined by the IC's internal ROM).

The diagram shows [in *(b)* and *(c)*] basic ways of using the IC to make a complete melody generator with either a piezo sounder or a loudspeaker output. Note in these and most other melody generator IC circuits that, after connecting the supply by closing S1, the melody plays once and then stops; the supply must be broken and then reconnected to retrigger the IC.

The basic UM66T-series IC is currently (at the time of writing) manufactured in a total of 14 basic 'English-language Tune' sub-variants (indicated by the first two bits of a three-digit/letter suffix to the main IC part number), each of which plays a different tune or abbreviated set of melodies, as indicated in the table shown in *Figure 2*. The two most popular of these sub-variants are the UM66T08x, which plays *Happy Birthday To You*, and the UM66T09x, which plays Mendelssohn's *Wedding March*.

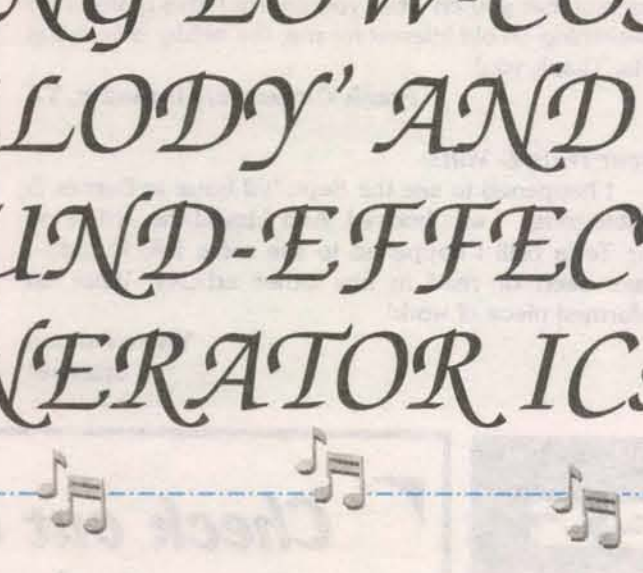


***Figure 1.* Outline and basic application circuits of the UM66T melody generator IC.**

IC PART NO.	SONG NAME
UM66T01x	Jingle Bells + Santa Claus is Coming to Town + We Wish You a Merry Christmas
UM66T02x	Jingle Bells
UM66T04x	Jingle Bells + Rudolph the Red Nosed Reindeer + Joy to the World
UM66T05x	Home Sweet Home
UM66T06x	Let Me Call You Sweetheart
UM66T08x	Happy Birthday to You
UM66T09x	Wedding March (Mendelssohn)
UM66T11x	Love Me Tender, Love Me True
UM66T13x	Easter Parade
UM66T19x	For Elise
UM66T32x	Cuckoo Waltz
UM66T33x	Mary Had a Little Lamb
UM66T34x	The Train is Running Fast
UM66T68x	It's a Small World

***Figure 2.* Tune-play details of 14 English-language sub-variants of the basic UM66T-series IC.**

PLEASE NOTE that most of the ICs described in this article are CMOS types with unprotected inputs, and are thus highly susceptible to catastrophic damage from electrostatic discharges when being handled. Readers wishing to experiment with any of these ICs are *strongly advised* to take all normal 'CMOS handling' precautions, including the wearing of a grounded wrist strap.

The M66T series (Micro-E)

Figure 3 shows basic details of the M66T melody generator IC, which is housed in a three-pin TO-92 package, can be powered from a 1.3V to 3.6V battery supply, consumes a quiescent current of less than 1µA, generates an internally limited output drive current, and can play a tune of up to 64 notes (determined by the IC's internal ROM).

The M66T IC has greater output driving power than the UM66T type, and *Figure 3(b)* shows a basic way of using it to directly drive an eight-

Remember, you're not limited to holiday songs. Use tunes like: Old MacDonald Had a Farm; Love Me Tender; Twinkle, Twinkle, Little Star; You Are My Sunshine; Greensleeves; the list goes on. *Plus*, don't forget about available sound effects like police cars, rockets, cows, dogs, jets, and chickens, just to name a few.

ohm speaker when the circuit is powered from a 1.5V battery supply. Alternatively, *Figure 4* shows basic ways of using the IC as a melody generator that uses a 1.5V to 3.5V supply and has either a piezo sounder or a loudspeaker output.

The basic M66T-series IC is manufactured in more than 200 sub-variants (each indicated by a suffix to the main part number), each of which plays a different tune or abbreviated set of melodies. The table in *Figure 5* presents basic 'tune' details of the five most popular and widely available 'English-language Tune' ICs in the range.

The HT381xx series (Holtek)

The Holtek HT381xx series of melody generator ICs (strangely listed as the 'HT3810' series in the Holtek data book) is far more sophisticated than the UM66T-series or M66T-series devices, and is intended primarily for use in telephone and toy/game applications, rather than in greeting cards. The IC incorporates two tone generators and a 'CHA' sound generator, etc., and can play a tune of up to 128 notes; the IC needs a 2.4V to 5V DC supply, consumes a typical standby current of 10µA, and plays one complete tune each time the supply is connected to the IC.

The HT381xx series of ICs are produced in both 11-pad 'chip' form (for use by bulk-purchase companies) and in standard three-pin TO-92 package form. *Figure 6* shows basic details of the TO-92 package, plus two basic ways of using the IC as a melody generator that uses a 2.4V to 5V supply and has either (b) a piezo sounder or (c) a loudspeaker output.

The HT381xx series of ICs are currently produced in a total of 74 sub-variants, each indicated by a two-part (one numeral plus one letter) suffix to the main part number; each IC variant plays a different English-language tune or abbreviated set of melodies. The available tunes are, for IC numbering purposes, classified in four basic 'class' groups; the table in *Figure 7* shows the basic relationship between the IC numbers and the general class of tune that they play. *Figure 8* shows specific tune-play details of 12 popular sub-variant ICs in the basic HT381xx range of devices.

SOUND-EFFECTS GENERATOR IC CIRCUITS

Sound-effects generator ICs are sophisticated but inexpensive and easy-to-use devices that (usually) contain both tone and white-noise generators and are intended mainly for use in toys and in domestic gadgets such as alarms and doorbells. Very simple ICs of this type generate only one specific type of sound; other — more sophisticated — types can generate several different sound effects.

Holtek is the leading producer of sound-effect generator ICs, and produce the devices in both chip and encapsulated versions, and in both custom-programmed and general-purpose form.

The rest of this section presents practical usage information on the most popular 'encapsulated' versions of various general-purpose CMOS sound-effects generator ICs that are currently available from the *Holtek* range.

When using these ICs, note that many of them have one or more 'TEST' (T) pins, which should be left open when the IC is in normal use. Readers seeking additional up-to-date information on the Holtek range of ICs can access it via the Holtek web site at http://www.holtek.com.

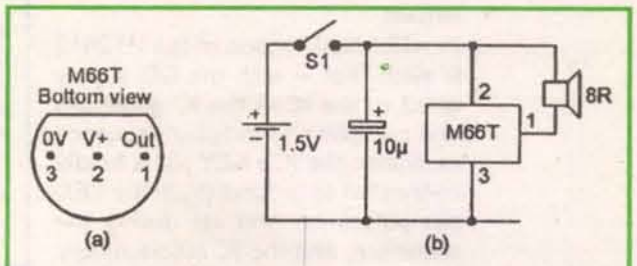


***Figure 3.* Outline and simple application circuit of the M66T melody generator IC.**

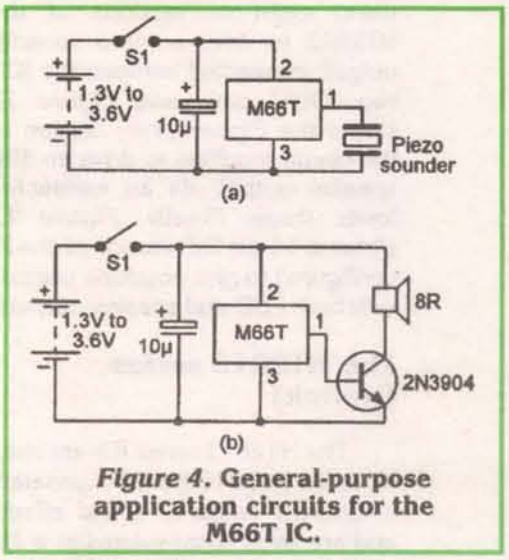


***Figure 4.* General-purpose application circuits for the M66T IC.**

The HT2812 series (Holtek)

The HT2812-series ICs each generate a single sound effect in an external speaker or piezo sounder; they operate from a 2.4V to 3.3V DC supply, consume a typical standby current of 1µA, have their main oscillator frequency controlled by a single external 'R_{OSC}' resistor, and feature built-in envelope control and automatic power-off action.

The series is currently produced in nine popular sub-variants, each indicated by a one letter suffix to the main part number; each IC variant generates a different sound effect, as shown in the table in

IC PART NO.	MELODY/SOUND	DURATION
M66T-02B	Twinkle Twinkle Little Star	16.4 secs
M66T-11	Rock-a-bye Baby	21.6 secs
M66T-36	Old MacDonald Had a Farm	24.8 secs
M66T-205	I'd Like to Teach the World to Sing	20.4 secs
M66T-214	White Christmas	49.5 secs

***Figure 5.* Tune-play details of the five most popular English-language sub-variants of the M66T IC.**

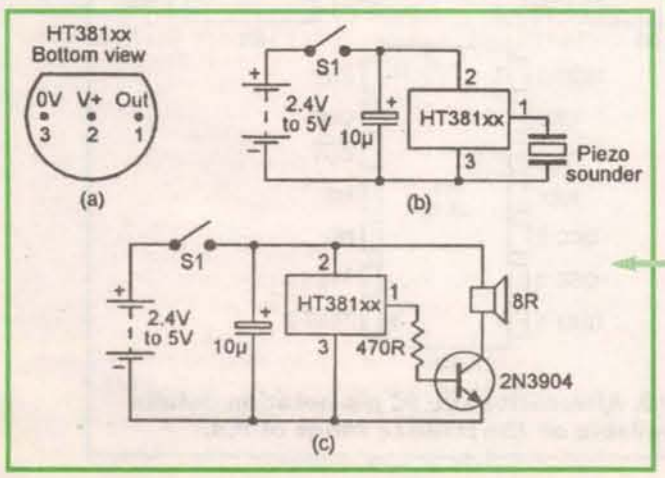


***Figure 6.* TO-92 outline and basic application circuits of the HT381xx melody generator IC.**

PIC'n Books
LEARN ABOUT PIC MICROCONTROLLERS

See Table Of Contents: http://www.sq-1.com
Secure Online Ordering Is Available
PIC is a trademark of Microchip Technology Inc.
SQUARE 1 ELECTRONICS
Voice (707) 279-8881 Fax (707) 279-8883
http://www.sq-1.com

Figure 9, which also shows the nominal R_{OSC} value for use with each IC variant.

The HT2812 series is produced in three alternative package forms, as shown in *Figure 10*. The 14-pin DIL type has both LED output and envelope-control (ENV) pins; the eight-pin DIL type has a LED output on pin 4 in the *Figure 10(a)* variant, or an ENV pin in the *Figure 10(b)* variant.

The basic action of the HT2812 is such that — with the DC supply wired to the IC — the IC generates one complete sound-play sequence each time the IC's KEY pin is briefly connected to ground (V_{ss}); the LED pin pulses on and off during the sequence, and the IC automatically goes into the 'standby' mode at the end of the sequence.

Figure 11 shows basic ways of using eight-pin versions of the HT2812 to drive a piezo sounder output, connected between the IC's two 'OUT' pins, and *Figure 12* shows the *Figure 11(b)* version of the circuit modified to drive an 8R0 speaker output via an emitter-follower stage. Finally, *Figure 13* shows a 14-pin DIL version of the IC configured to give envelope control, with both LED and speaker outputs.

The HT2813 series (Holtek)

The HT2813-series ICs are similar to the HT2812 type, but generate a different range of sound effects and are each encapsulated in a 16-pin DIL package. *Figure 14* shows basic sound-play and 'R_{OSC}' resistor value details of the five most popular ICs in the range, and *Figure 15* shows the IC's outline and pin notations. *Figure 16* shows the basic connections for using an HT2813 IC with a speaker or (shown dotted) a piezo sounder output.

The HT2821 series (Holtek)

The HT2821-series ICs are similar to the HT2812 type, but each generate two different sound effects (each controlled by its own key switch) and are encapsulated in a 14-pin DIL package; they operate from a 2.4V to 3.3V DC supply, consume a typical standby current of 1µA, and have their main oscillator frequency controlled by a single external 'R_{OSC}' resistor.

The two most popular ICs in the range are the HT2821A, which generates machine gun and bombing sounds and needs a 180k 'R_{OSC}' value, and the HT2821E, which generates brake and explosion sounds and needs a 560k 'R_{OSC}' value.

Figure 17 shows the outline and pin notations of the HT2821 IC, together with the basic connections for using it with a speaker or (shown dotted) a piezo sounder output, but with the ENV facility unused.

The HT2830 series (Holtek)

The HT2830-series ICs use an 18-pin DIL package and each generate a push-button controlled variable-rate 'base' sound (such as that of a jet engine, a helicopter rotor, or a train), plus two push-button controlled 'fighting' sounds (such as a machine gun and a missile, or a bell and a horn). The ICs operate from a 2.4V to 3.3V DC supply, consume a typical standby current of 1µA, have their main oscillator frequency controlled by a single external 'R_{OSC}' resistor, and have provisions for driving two external LEDs, which flash

IC PART NO.	SONG (TUNE) SERIES	NO. OF SONGS
HT3810A to HT3810Z	Children's Songs	25
HT3811A to HT3811G	Children's Songs	7
HT3812A to HT3812Q	Lyrical Songs	16
HT3813A to HT3813M	Christmas Songs	13
HT3814A to HT3814M	Popular Songs	13
		Total = 74

***Figure 7.* Relationship between HT381xx IC numbers and the general class of tune that they play.**

IC PART NO.	SONG NAME
HT3810B	Happy Birthday to You
HT3810N	London Bridge is Falling Down + The Train is Running Fast
HT3810W	Old MacDonald Had a Farm
HT3811A	Popeye the Sailor Man
HT3811G	Mary Had a Little Lamb
HT3812A	Greensleeves
HT3813A	Jingle Bells
HT3812G	Love Me Tender
HT3813E	We Wish You a Merry Christmas
HT3813M	Hark, the Herald Angels Sing + The 12 Days of Christmas
HT3814A	You Are My Sunshine
HT3814K	I Just Called to Say I Love You

***Figure 8.* Tune-play details of 12 popular sub-variants of the HT381xx melody generator IC.**

IC PART NO.	SOUND EFFECT	R_{OSC} VALUE (nominal)
HT2812A	Airplane	390k
HT2812B	Rocket	220k
HT2812C	Siren II	390k
HT2812D	Police Car	150k
HT2812E	Fire Brigade	150k
HT2812F	Siren I	390k
HT2812H	Dialing Tone	390k
HT2812J	Chicken Sound	62k
HT2812K	Ambulance Sound	390k

***Figure 9.* Sound-play and R_{OSC} details of nine popular sub-variants of the HT2812 sound-effects generator ICs.**

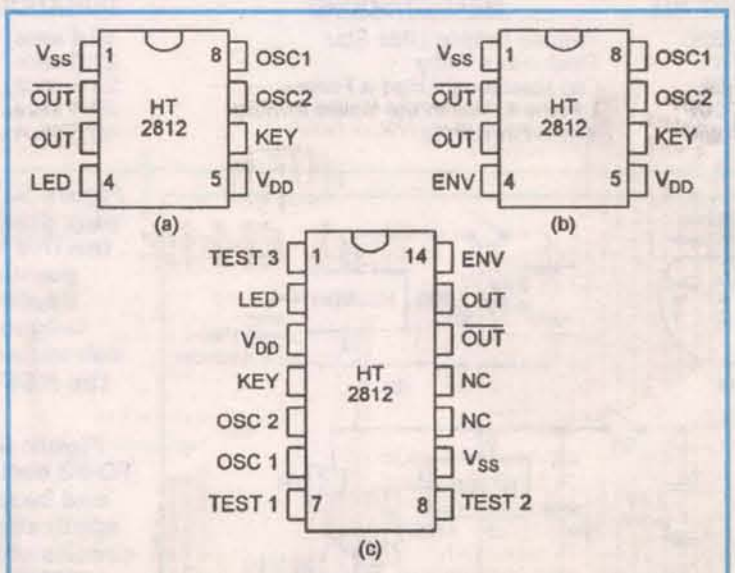
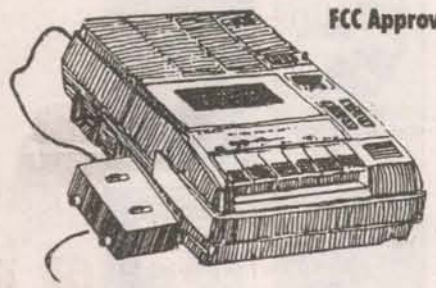


***Figure 10.* Alternative DIL IC pin-notation details available on the HT2812 range of ICs.**

TELEPHONE LISTENING DEVICE WITH 12 HR. RECORDER



FCC Approved

Record telephone conversations in your office or home. Starts automatically when phone is answered, records both sides of phone conversation. Recorder stops when phone is hung up. $99.95 + $7 shipping. For telehone listening device separately $19.95 + $2 ship.

For comprehensive 50 page catalog of Micro Video, VHF transmitters,Surveillance, and Counter-surveillance and much more! Send $3.00

Call 407-725-1000

USI CORP

P.O. Box N2052 Melbourne,FL 32902

COD'S OK

Write In 107 on Reader Service Card.

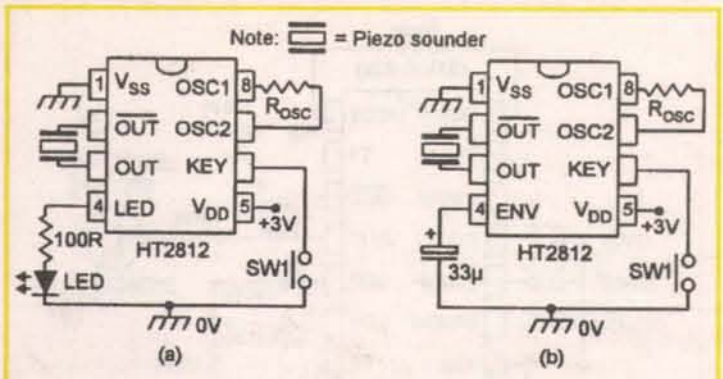


Figure 11. **Eight-pin DIL HT2812 piezo-output application circuits with (a) LED display and (b) envelope control.**

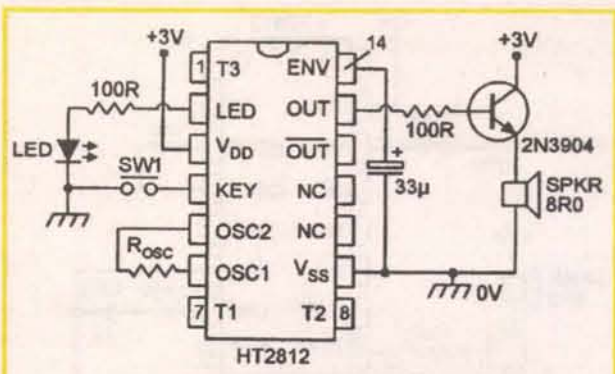


Figure 13. **14-pin DIL HT2812 speaker-output application circuit with LED output and envelope control.**

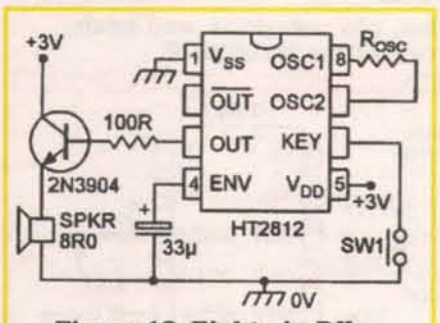


Figure 12. **Eight-pin DIL HT2812 speaker-output application circuit with envelope control.**

IC PART NO.	SOUND EFFECT	R_{OSC} VALUE (nominal)
HT2813D	Ghost	120k
HT2813E	Bird Song 1	56k
HT2813F	Bird Song 2	56k
HT2813G	Cow	62k
HT2813H	Little Dog	300k

Figure 14. **Sound-play and R_{OSC} details of five popular sub-variants of the HT2813 sound-effects generator ICs.**

at a rate proportional to the base sound rate.

Figure 18 shows the outline and pin notations of the HT2830 IC, together with the basic connections for using it with a speaker or (shown dotted) a piezo sounder output. The IC's base-sound rate can by increased via SWUP or decreased via SWDN, and the two fighting sounds can be selected via SWA or SWB. The R_{OSC} value is typically in the range 51k (for the HT2830B 'helicopter sound' IC) to 82k (for the HT2830C 'train sound' IC).

The HT2844 series (Holtek)

The HT2844-series ICs use a 16-pin DIL package and each generate four independent push-button activated sound effects. The ICs operate from a 2.4V to 3.3V DC supply, consume a typical standby current of 1µA, have their main oscillator frequency controlled by a single external 'R_{OSC}' resistor, and have provisions for driving one external LED.

The series contains seven general-purpose ICs, which each generate four sounds of a particular type; *Figure 19* shows the sound-play and R_{OSC} details of these seven ICs,

Micro Video Specialist

MB-650PA -$Call 2.8mm Pinhole Lens.
MB-650UA -$Call 4.3mm Micro. Lens
MB-750P -$Call 2.8mm Pinhole Lens.
MB-750U -$Call 4.3mm Micro. Lens

MB-650a Series
• Built-In Audio
• 1.18" sq.
• 380 TV Line

MB-750 Series
• 1.25" sq.
• 420 TV Line

We Match or Beat All Prices! Free Power Supply with Board Camera Purchase!

7 Optional Micro Lenses

Lens	Angle of View	Price
2.5mm	(150°)	$29.95
3.6mm	(92°)	$29.95
4.3mm	(68°)	$29.95
6.0mm	(53°)	$29.95
8.0mm	(40°)	$29.95
12mm	(28°)	$29.95
16mm	(19°)	$29.95

Buy All 7 Lenses & Save. 7-Pack of Lenses $99.95
Lens FocusingGrommet LFG-01 $1.95
Ask for the Quick-Start KIT Accessory

Flat Screen TFT-LCD Monitors
TFT-4 $179.95
Color 4" Screen. (Size: 6"(W) x 4.5"(H) x 2"(D) An excellent 4" monitor for one camera monitoring or for setting up cameras during installation or maintenance.
COLOR 5.6" TFT and 6.4" TFT Monitors
TFT-5.6 $399.95
TFT-6.4 $449.95
(Includes: patch cable & power supply)

Wireless Transmitter Modules
Makes any Camera Wireless. When wires are impossible to run, our wireless transmitters & receivers are lightweight and excellent for Hobbyist. Small enough to place anywhere. Can operate off of 12VDC or Battery Power supply.
FCC Approved
2.4 GHz
"Portable" Color Wireless System
GM-2400 $269.95 (Monitor/Receiver)
GC-2400 $229.95 (Camera)
SJ-2400TX 2.4 GHz $149.95
The "Slim Jim" 2.4 Ghz FM Module with 1 touch channel selection with memory, Advanced 3ua sleep mode, and Stereo Audio.
SJ-2400TX Size & Weight
3.8"(L) x 1.12"(H) x 0.63"(D)
Weight w/ Antenna is 1.5 oz
Antenna 3.5"(L) w/ 7.5" Cable.
GW-2400 $229.95
• 1 - 4 Transmitting Channels.
• Can be integrated with other wireless applications.
• Up to 985 ft. Operating Distance.
•Dimensions: 2.5"(W) x 2.18"(H) x 3.28"(D)
Video/Stereo Audio
GW-2400S - $449.95
Includes: 2.4 Ghz Color Wireless Camera. Receiver with Built-In Monitor.
Transmitter
Receiver

The Door Video Camera Is Designed to replace a Standard Front Door Peep Hole!
• For Home or Office.
• Shipping/Receiving.
• Employee Entrance.
Outside
Inside
Camera Lens
Video & Power Cable
Door or Wall
DV-810 $199.95

15 Years of Quality Service
FREE Polaris Products Catalog
100's of Video Products

Cameras with Built-in Infrared Illuminators.
LP-850w
Operates on 0.0 LUX in Total Darkness. Weatherproof Video Camera!
LP-850w $169.95
- NEW MB-810B - High Powered IR-LED's. 10 X's the power!
CAMERAS THAT CAN SEE IN TOTAL DARKNESS
MB-810B
• New BLC
• Multi-Mount option
• High Resolution
MB-810B $119.95
Inter Board Size: 1.2"sq.
Outer Board Size: 1.7"sq.

Polaris Industries
http://www.polarisusa.com
1-800-752-3571
470 Armour Drive NE • Atlanta GA 30324-3943 • Tech Info 404.872.0722 • FAX 404.872.1038

Write in 108 on Reader Service Card.

HOLIDAY PROJECT

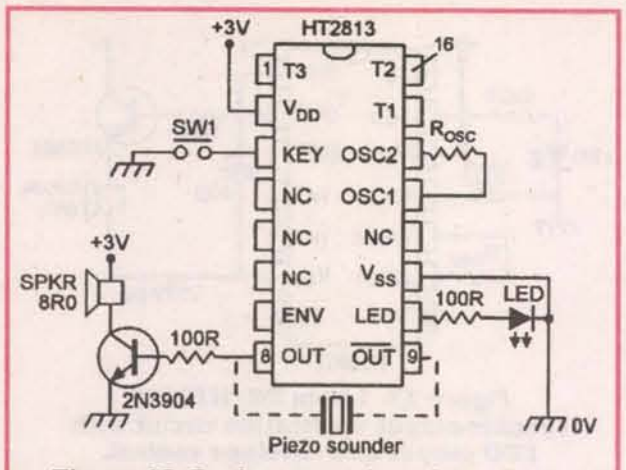


Figure 16. **Basic connections for using an HT2813 IC with a speaker or (shown dotted) piezo sounder output.**

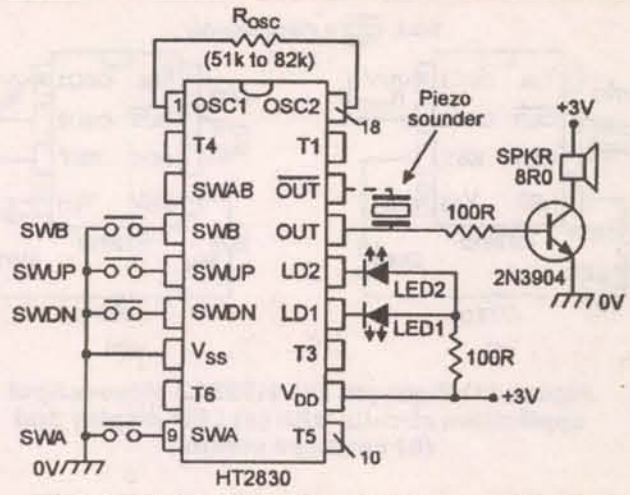


Figure 18. **Outline, pin notations, and basic usage circuit of the HT2830 IC.**

and *Figure 20* shows the outline, pin notations, and basic usage circuit of the HT2844 IC, using either a speaker or a piezo sounder output.

The HT2860 series (Holtek)

The HT2860-series ICs each generate six different sound effects, which can each be triggered via an external key (K) switch. The six sound effects are priority rated from K1 (highest priority) to K6 (lowest priority); thus, if a single K switch is closed, the associated sound effect plays for the duration of the switch closure, but if a number of K switches are closed simultaneously (say K1, K3, and K5), the IC repeatedly plays through the selected sound effects in their priority sequence (K1-K3-K5-K1, etc.) for the duration of the multiple-switch closure.

The HT2860-series ICs operate from 2.4V to 4.5V DC supplies, consume a typical standby current of 1µA at 3V, have their main timing controlled by two external resistors, have a power-on reset (PWR) feature that is controlled by a single external 102pF capacitor, and use either a 16-pin or 18-pin DIL package.

The two most popular ICs in the range are the HT2860B, which uses an 18-pin DIL package and generates six different alarm sounds, and the HT2860C, which uses a 16-pin DIL package and generates four different alarm sounds plus a horn sound (K5) and an ambulance sound (K6); *Figures 21* and *22* show the IC outlines, pin notations, and basic usage circuits of these two ICs.

The HT2883/ HT2885 series (Holtek)

The HT2883 and

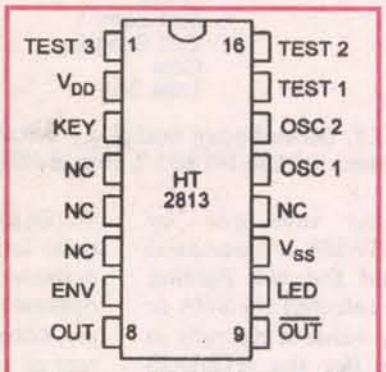


Figure 15. **Outline and pin notations of the HT2813 range of ICs.**

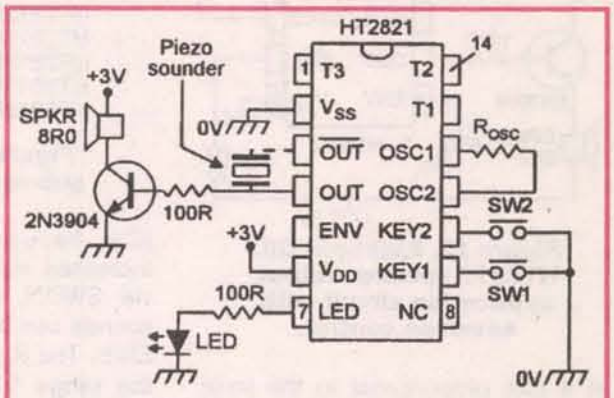


Figure 17. **Outline, pin notations, and basic usage circuit of the HT2821 IC, with ENV facility unused.**

IC Part Number & Sound Type	Sound 1	Sound 2	Sound 3	Sound 4	ROSC Value (nominal)
HT2844 (toy guns)	Rifle	TV Game	Bombing	M.G.	220k
HT2844C (animals)	Chick	Cricket	Frog	Bird	220k
HT2844M (helicopter)	Rotor (fast)	Rotor (slow)	Explosion	M.G.	270k
HT2844N (racing cars)	Engine (slow)	Engine (fast)	Horn	Brake	270k
HT2844P (Jet aircraft)	Jet (slow)	Jet (fast)	Missile	M.G.	430k
HT2844S (morning call)	Phone	Siren	Ambulance	Melody*	560k
HT2844T (alarms)	← Four different 'alarm' sounds →				220k

*Melody is London Bridge is Falling Down

Figure 19. **Sound play and R_{OSC} details of seven popular variants of the HT2844 sound-effects generator ICs.**

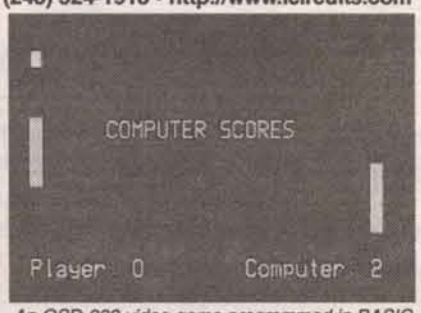
ON SCREEN DISPLAY- CHARACTER OVERLAY BOARD

Need to display more text than your LCD module can handle? OSD-232 is the solution! From any RS-232 serial source like a PC or Basic Stamp, display 28 columns by 11 rows of information (308 characters total) directly onto any NTSC or optional PAL baseband (video in) television or VCR. OSD-232 can overlay monochrome text onto an incoming video source or display colored text on a self-generated colored background screen.

OSD-232 $99.00
We accept Visa and Mastercard.

Intuitive Circuits, LLC
2275 Brinston • Troy, MI 48083
(248) 524-1918 • http://www.icircuits.com

OSD-232 on board a radio controlled airplane



An OSD-232 video game programmed in BASIC

Mr. NiCd — DECEMBER 1999 SUPER SPECIALS! — THE BEST BATTERIES IN AMERICA!

Packs & Charger for YAESU FT-50R / 40R / 10R:
FNB-40xh Slim-NiMH 7.2v 650mAh $41.95
FNB-47xh (NiMH) 7.2v 1800mAh $49.95
FNB-41xh (5w NiMH) 9.6v 1000mAh $49.95
For YAESU FT-51R / 41R / 11R:
FNB-38 pack (5W) 9.6v 700mAh $39.95
For YAESU FT-530 / 416 / 816 / 76 / 26:
FNB-26 pack (NiMH) 7.2v 1500mAh $32.95
FNB-27s (5w NiMH) 12.0v 1000mAh $45.95
For YAESU FT-411 / 470 / 73 / 33 / 23:
FNB-11 pack (5w) 12.0v 600mAh $24.95
FBA-10 6-Cell AA case $14.95
Packs for ALINCO DJ-580 / 582 / 180 radios:
EBP-20ns pack 7.2v 1500mAh $29.95
EBP-22nh pk.(5w) 12.0v 1000mAh $36.95
EDH-11 6-Cell AA case $14.95
For ICOM IC-Z1A / T22-42A / W31- 32A / T7A:
BP-180xh pk. (NiMH) 7.2v 1000mAh $39.95
BP-173 pack (5w) 9.6v 700mAh $49.95
For ICOM IC-W21A / 2GXAT / V21AT:(Black or Gray)
BP-132s (5w NiMH) 12.0v 1500mAh $49.95

For ICOM IC-2SAT / W2A / 3SAT / 4SAT etc:
BP-83 pack 7.2v 600mAh $23.95
For ICOM 02AT etc & Radio Shack HTX-202 / 404:
BP-8h pack 8.4v 1400mAh $32.95
BP-202s pack (HTX-202) 7.2v 1400mAh $29.95
For KENWOOD TH-79A / 42A / 22A:
PB-32xh pack (NiMH) 6.0v 1000mAh $29.95
PB-34xh pack (5w NiMH) 9.6v 1000mAh $39.95
For KENWOOD TH-78 / 48 / 28 / 27:
PB-13 (original size!) 7.2v 700mAh $26.95
For KENWOOD TH-77, 75, 55, 46, 45, 26, 25:
PB-6x (NiMH, w/chg plug!) 7.2v 1200mAh $34.95

Mail, phone, & Fax orders welcome! Pay with Mastercard / VISA / DISCOVER / American Express
Call 608-831-3443 / Fax 608-831-1082
Mr. NiCd - *E. H. Yost & Company*
2211-D Parview Road, Middleton, WI 53562
CALL OR WRITE FOR OUR FREE CATALOG!
Cellular / Laptop / Videocam / Commercial & Aviation packs too!
E-mail: ehyost@midplains.net

Write in 109 on Reader Service Card.

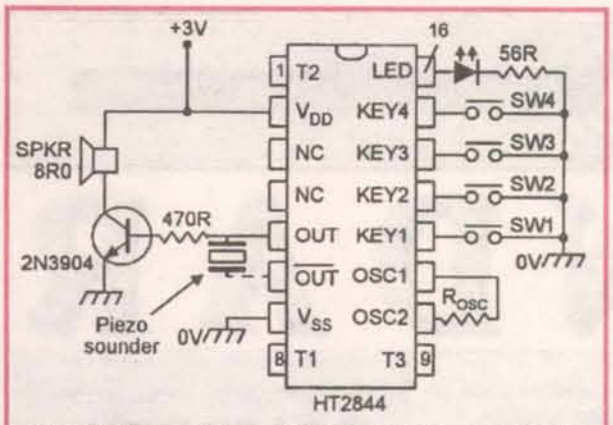


Figure 20. **Outline, pin notations, and basic usage circuit of the HT2844 IC.**

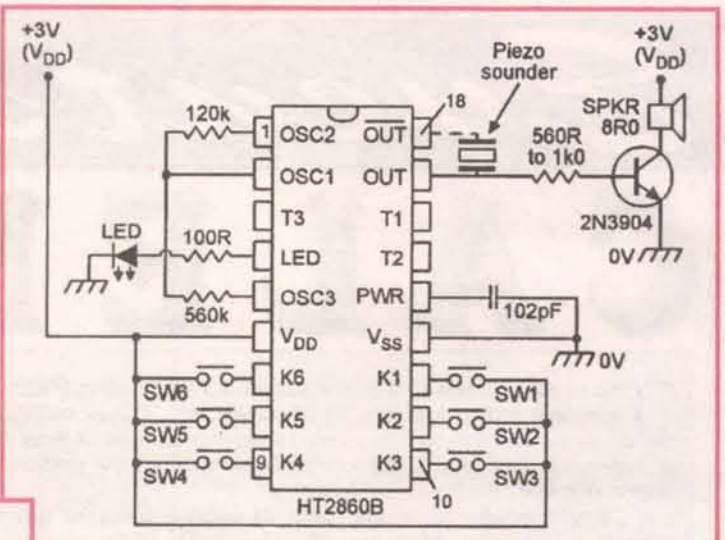


Figure 21. **Outline, pin notations, and basic usage circuit of the HT2860B IC.**

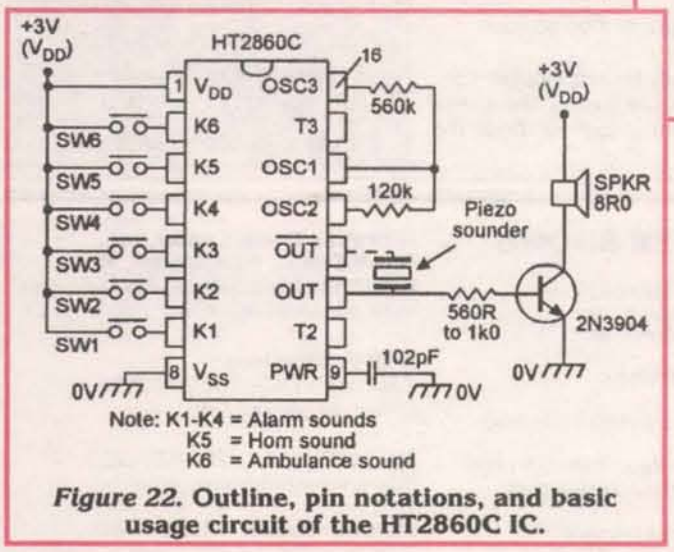


Figure 22. **Outline, pin notations, and basic usage circuit of the HT2860C IC.**

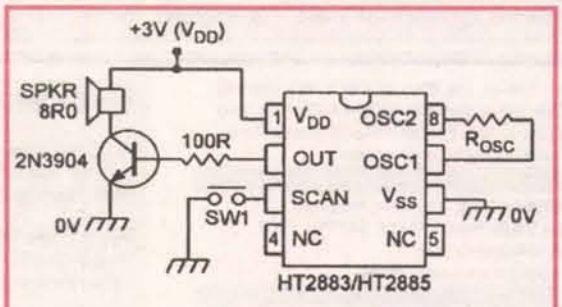


Figure 24. **Outline, pin notations, and basic usage circuit of the eight-pin version of the HT2883/HT2885 IC.**

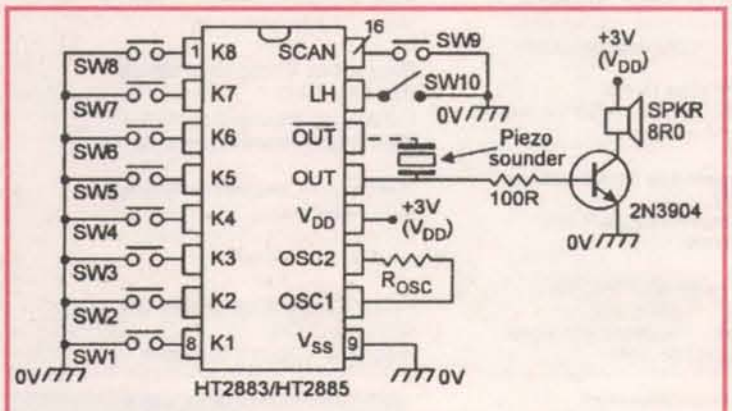


Figure 23. **Outline, pin notations, and basic usage circuit of the 16-pin version of the HT2883/HT2885 IC.**

IC Part Number	Manufacturer's Classification of the Eight Available Sound Effects	Available DIL IC Types	R_{OSC} Value (nominal)
HT2883	Toy Gun Sounds	8-pin/16-pin	150k
HT2883E	Submarine War Sounds	16-pin	330k
HT2883F	Helicopter War Sounds	16-pin	330k
HT2883I	Racing Car Sounds	16-pin	330k
HT2885	Toy Gun Sounds	8-pin/16-pin	150k
HT2885D	Toy Phone Sounds	16-pin	270k

Figure 25. **Sound play, IC packaging and R_{OSC} details of the main variants of the HT2883/HT2885 sound-effects generator ICs.**

HT2885 series ICs operate from 2.4V to 3.3V DC supplies, consume a typical standby current of 1µA, have their main timing controlled by a single external 'R_{OSC}' resistor, and are each capable of generating eight different sound effects, which are priority rated from K1 (highest priority) to K8 (lowest priority); ICs in the series are produced in 16-pin DIL and/or eight-pin DIL forms.

Figure 23 shows the outline, pin notations, and basic usage circuit of the 16-pin DIL version of the HT2883/HT2885, using either a speaker or a piezo sounder output. The basic action of this IC is such that any one of the eight available sound effects can be individually activated by closing its own key (K) switch, or the effects can be activated sequentially — in their priority order — by activating SCAN switch SW9.

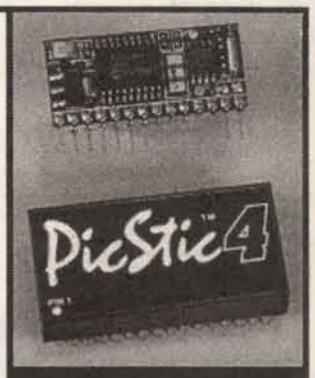
When the sounds are keyed independently, they are keyed in the 'one-shot' (fixed duration) mode when the LH (level hold) pin is open (SW10 open), or are keyed for the duration of the 'K' switch closure when the LH pin is grounded (SW10 closed).

When the IC is keyed in the sequential mode, the sounds scan sequentially throughout the duration of the SCAN key (SW9) closure in the HT2883, or scan one step and then repeat for the duration of the SW9 closure in the HT2885 (this SCAN function is independent of the LH key and is the only difference between the HT2883 and HT2885 versions of the IC).

Figure 24 shows the outline, pin notations, and basic usage circuit of the eight-pin DIL version of the HT2883/HT2885, which is designed to drive a speaker output and operates in the sequential scanning mode only.

The HT2883/HT2885 series of ICs is produced in a variety of subvariants; *Figure 25* lists basic details of the six most important and generally-available ICs is the series. NV

Honey, I shrunk the COMPUTER!



PicStics are like BASIC Stamps® on steroids. They have more speed, more parallel I/O, more code and data space, and more neat features like a real-time clock, 12-bit ADC, and 12-bit DAC.

As low as $29

Call for a catalog or visit our Web site today.

www.micromint.com

Micromint, Inc
740 Florida Central Pkwy., Longwood, FL 32750

(800) 635-3355
(407) 262-0066

BASIC Stamp is a registered trademark of Parallax, Inc.

Write in 110 on Reader Service Card.

Events

CALENDAR

The Events Calendar is a free service for publicizing electronic events such as amateur radio hamfests, flea markets, etc. If your organization is sponsoring an event and would like a free listing, contact us at least 60 days in advance. Include your flyer, estimated attendance, name of the person to contact, and phone number.

Complimentary issues are available upon request for distribution to your attendees. A street addres for UPS is required.

While we strive for accuracy in our calendar, we can not be responsible for errors or cancellations. The information contained in this column is for the use of the readers of *Nuts & Volts* and may not be republished in any form without the written permission of T & L Publications, Inc.

All listing information should be sent to:
Nuts & Volts Magazine
Events Calendar
430 Princeland Court
Corona, CA 92879
Phone 909-371-8497
Fax 909-371-3052
E-mail events@nutsvolts.com

DECEMBER 1999

DECEMBER 4

AL - DOTHAN - Hamfest. Wiregrass ARC, Percy Garrett KF4DYV, 334-692-3689
Web: http://www.qsl.net/warc/eflyer.htm
AZ - MESA - Hamfest. AR Council of AZ, Mark Kesauer N7KKQ, 602-779-2722.
E-Mail: arcathill@aol.com
CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
FL - OKEECHOBEE - Hamfest. Okeechobee ARC, Bill Gastle,
E-Mail: wgastle@okeechobee.com
GA - CLAXTON - Hamfest. Claxton ARES, John Perkins W4HYU, 912-739-4589.
E-Mail: w4hyu@juno.com
LA - MINDEN - Hamfest. Minden ARA, Lowell A. "Dusty" Collins KB5WFE, 318-371-0636.
E-Mail: dusty1@microgear.net Web: http://www.microgear.net/gwinford/mara.htm

DECEMBER 4-5

FL - STARKE - Hamfest. Waldo Trading Post Bluegrass area, US 301 S, behind the flea market. Sat: 9am-5pm, Sun: 9am-4pm. Talk-in: 145.150. ARC Bradford Area, John Bradley, 904-782-1185; E-Mail: jbradley@techcomm.net. Tony Spatafore, 904-964-9328; E-Mail: wb2fgl@techcomm.net
Web: http://www.angelfire.com/fl/arcba/index.html

DECEMBER 5

IN - GREENFIELD - Hamfest. Greenfield Central High School Pavilion, N. Broadway St. Talk-in: 145.330, 444.725. Hancock ARC, Tom Donaldson N9LFU, 317-326-3168.
E-Mail: tomd@freewwweb.com
Web: http://www.iei.net/~n9hqo

DECEMBER 11

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves
SC - UNION - Hamfest. National Guard Armory, Industrial Park Dr. 8am-2pm. Union County ARC, Roger W. Gregory KI4RG, 864-427-1462.
E-Mail: KI4RG@arrl.net

DECEMBER 18

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-005

JANUARY 2000

JANUARY 7-8

FL - GAINESVILLE - Hamfest. Alachua County Fairgrounds, SR-222 (3400 NE 39th Ave.), 1/2 mi. E. of SR-24 (Waldo Rd.). Talk-in: 146.820 (-). Gainesville ARS, Tom Scott KF4I, 352-378-9711 eves. E-Mail: k4gnv@arrl.net
Web: http://www.gars/net/hamfest/

JANUARY 8

CO - LOVELAND - Hamfest. Larimer County Fairgrounds, 700 Railroad Ave. 9am-3pm. VE exams. Talk-in: 145.115 (- offset, 100Hz) or 146.52. NCARC, Michael Robinson N7MR, 970-225-7051. E-Mail: michael@frii.com
Web: www.info2000.net/~ncarc
WI - WAUKESHA - Hamfest. Waukesha Co. Expo Center Forum. 8am-2pm. VE exams. West Allis RAC, Phil Gural W9NAW, 414-425-3649.

JANUARY 8-9

FL - FT. MYERS - Hamfest. Ft. Myers ARC, Doug Douglas N8SAQ, 941-542-4741.
E-Mail: douglas2@iline.com

JANUARY 9

IN - SOUTH BEND - Hamfest. Century Center, US33 N. & Jefferson Blvd. 8am-3pm. Talk-in: 145.290. Michiana Valley Hamfest Assn., Bob Denniston KA9WNR, 219-291-0252, M-F 7pm-10pm

JANUARY 15

AZ - GLENDALE - Hamfest. ARCA & ADAW, Mark Kesauer N7KKQ, 602-779-2722.
E-Mail: arcathill@aol.com
Web: http://www.phx-az.com/arca
LA - HAMMOND - Hamfest. South East LA ARC, Nathan Gifford N5BFC, 504-465-7522.
E-Mail: n5bfc@arrl.net
Web: http://www.selarc.org/selarchamfest.html
MI - FLUSHING - Hamfest. Amateur Radio & Youth, Clay Hewitt KF8UI, 810-233-7889.
E-Mail: clay@iavbbs.com
Web: http://www.qsl.net/aray/page6.html
MO - ST. JOSEPH - Hamfest. Ramada Inn, I-29 & Frederick Ave. (exit 47). 8am-3pm. FCC exams. Talk-in: 146.85 & 444.925. MO Valley & Ray-Clay ARCs, Kevin R. Phillips KC0AWM, 816-320-2129. E-Mail: KevinRPhillips@hotmail.com
Web: http://www.kc.net/~oconnor

JANUARY 15-16

FL - SARASOTA - Hamfest. Sarasota ARA, William Eddie Martin KI4ZJ, 941-954-1869.
E-Mail: ki4zj@msn.com
Web: http://www.saraclub.org

JANUARY 16

MI - HAZEL PARK - Hamfest. High School, 23400 Hughes St. 8am-2pm. Talk-in: 146.64 (-). HPARC, Tom Krausnick WC9F, E-Mail: wc9f@arrl.org Web: http://www.qsl.net/w8hp
NY - YONKERS - Flea Market. Lincoln High School, Kneeland Ave. 9am-3pm. VE Exams. Talk-in: 440.425 PL 156.7, 223.760 PL 67.0, 146.910, 443.350 PL 156.7. Metro 70cm Network, Otto Supliski WB2SLQ, 914-969-1053.
E-Mail: wb2slq@juno.com
Web: http://www.metro70cmnetwork.com
OH - NELSONVILLE - Hamfest. Sunday Creek AR Federation, Russ Ellis N8MWK, 740-767-2226.
E-Mail: scarf@hocking.edu
VA - RICHMOND - Frostfest. The Showplace, 3000 Mechanicsville Tpke. 8:30am-3:30pm. RATS, Jim Clark N3JJF, 804-739-2269 (Box 3378) or 804-271-1998. E-Mail: jim@compudata.net Web: http://frostfest.rats.net

JANUARY 22

FL - BROOKSVILLE - Hamfest. Hernando County Fairgrounds. 9am-4pm. Hernando County ARA, John Nedjedlo WB4NOD, 727-856-2568.
E-Mail: wb4nod@gate.net
Web: http://www.hcara.org
FL - PENSACOLA - Hamfest. University of West FL ARC, Ray Killough KE4UNR, 850-968-1048.
E-Mail: ke4unr@spydee.net
Web: http://qso.arc.uwf.org/~hamfest
MO - ST. CHARLES - Hamfest. St. Louis Repeater, Brad Ziegler KC0CDG, 314-569-5775.
E- Mail: kc0cdg@qsl.net
NC - WINSTON-SALEM - Hamfest. Forsyth ARC, John Kippe N0KTY, 336-723-7388. Web: http://members.xoom.com/w4nc/hamfest.htm
NH - NASHUA - Hamfest. Res Ctr Church. NE Antique RC 617-923-2665
TN - GALLATIN - Hamfest. Sumner County ARA, John Hermon WB5OOL, 615-451-0213.
E-Mail: hamfest@rogerg.com
Web: http://www.rogerg.com/scara

JANUARY 23

IL - CICERO - Hamfest. Wheaton Community Radio Amateurs, Don Motz N9NYX, 630-545-9950. E-Mail: hamfest2k@hotmail.com
Web: http://www.w9ccu.org
NY - BABYLON - Ham Radio University 2000. Town Hall Annex, Phelps Ln. 9am-3pm. Great South Bay ARC, Phil Lewis N2MUN, 516-226-0698. E-Mail: lewisp@hazeltine.com. Not a flea market or hamfest, no items for sale, solely for educational purposes.

JANUARY 29

AL - GREENVILLE - Hamfest. Butler County Fairgrounds. 8am-3pm. Talk-in: 146.67 or 145.19. Butler County & Pike County RACES, Jerry McCullough KE4ERO, 334-382-7644.
E-Mail: KE4ERO@alaweb.com

JANUARY 30

MD - ODENTON - Hamfest. Vol. Fire Dept. Hall, 1425 Annapolis Rd. (Rt. 175). 8am-2pm. Free VE testing, pre-register 410-761-1423. Talk-in: 146.205/805. MD Mobileers ARC, Bill Hampton N3WGM, 410-766-2199.

COMPUTER SHOWS

AGI Shows, 317-299-8827.
E-Mail: info@agishows.com
http://www.agishows.com

Blue Star Productions
612-788-1901.
http://www.supercomputersale.com

Computers And You, 734-283-1754.
www.a1-supercomputersales.com

Computer Central Shows
847-412-1900 & 1-888-296-6066.
E-Mail: compcent@megsinet.net
www.computercentralshows.com

Five Star Productions
810-379-3333. E-Mail: jeff@fivestar
www.fivestarshows.com

Georgia Mountain Productions
706-838-4827.
E-Mail: gamtnpro@blrg.tds.net
georgiamountain.com

Gibraltar Trade Center, Inc.
734-287-2000. Taylor, MI.
E-Mail: taylor@gibraltartrade.com
www.gibraltartrade.com

Gibraltar Trade Center, Inc.
810-465-6440. Mt. Clemens, MI.
E-Mail: mtclemens@gibraltartrade.com
www.gibraltartrade.com

KGP Productions
1-800-631-0062, 732-297-2526.
E-Mail: kgp@mail.com

MarketPro, Inc., 201-825-2229.
http://www.marketpro.com

MarketPro, Inc., 301-984-0880.
E-Mail: md@marketpro.com
http://marketpro.com

Narisaam Computer Show
770-663-0983.
E-Mail: narisaam@aol.com
Web: http://www.shownsale.com

Northern Computer Shows
978-744-8440.
E-Mail: inquiries@ncshows.com
Web: ncshows.com

Peter Trapp Computer Shows
603-272-5008.
Web: www.petertrapp.com

E-Mail: diamondb@space4less.com
Web: www.space4less.com/usr/mmarc
OH - DOVER - Hamfest. Tusco ARC, Billy Harper KB8CQG, 330-484-4634.
E-Mail: bharper@neo.rr.com

FEBRUARY 2000

FEBRUARY 4-5

MS - JACKSON - State Convention. Jackson ARC, Ron Brown AB5WF, 601-982-0101 or 601-956-1448. E-Mail: ab5wf@arrl.net
Web: http://www.jxnarc.org

FEBRUARY 5

KS - LA CYGNE - Hamfest. Mine Creek ARC, Mike Eyman W0XM, 913-898-4695.
E-Mail: w0xm@arrl.net
MI - NEGAUNEE - Hamfest. Hiawatha ARA, Bill Beitel N8NRG, 906-226-2779.
E-Mail: n8nrg@portup.com
SC - NORTH CHARLESTON - Hamfest. Charleston ARS, Jenny Myers WA4NGV, 843-747-2324. E-Mail: brycemyers@aol.com
Web: http://www.qsl.net/wa4usn/index.html

FEBRUARY 5-6

FL - MIAMI - Southeastern Division Convention. Fair Expo Center, 10901 SW 24th St. (Coral Way). Sat: 9am-5pm, Sun: 9am-4pm. Dade Radio Club, Evelyn Gauzens W4WYR, 305-642-4139.
E-Mail: edg@gzinc.com
Web: http://www.hamboree.org

FEBRUARY 11-12-13

FL - ORLANDO - State Convention. Orlando ARC, Ken Christenson KD4JQR, 407-291-2465.
E-Mail: KD4JQR@Juno.Com
Web: http://www.oarc.org/hamcat.html

FEBRUARY 12-13

TN - MEMPHIS - State Convention. W. Ben Troughton KU4AW, 901-372-8031. E-Mail: bktrough@mem.net Web: http://www.dixiefest.org

FEBRUARY 13

OH - MANSFIELD - Hamfest. Richland County Fairgrounds. Talk-in call W8WE 146.34/94. InterCity ARC, Inc., Pat Ackerman N8YOB, 419-589-7133

FEBRUARY 19

AR - RUSSELLVILLE - Hamfest. AR River Valley AR Foundation, Jonathan Setcer KC5BRY, 501-968-2938. E-Mail: hamfest@setcer.com
MA - MARLBOROUGH - Hamfest. Algonquin ARC, Ann Weldon KA1PON, 508-481-4988

FEBRUARY 20

MI - FARMINGTON HILLS - Hamfest. William M. Costick Activities Center, 28600 Eleven Mile Rd. 8am-3pm. Talk-in: 145.350, 146.52 simplex. Livonia ARC, Neil Coffin WA8GWL, club phone 734-261-5486. E-Mail: swap@larc.mi.org
Web: www.larc.mi.org

FEBRUARY 26

IN - LA PORTE - Hamfest. Civic Auditorium, 1001 Ridge. 7am-1pm. Talk-in: 146.520 simplex, 146.610 (131.8 PL). Neil Straub WZ9N, 219-324-7525. E-Mail: nstraub@niia.net
VT - MILTON - NVT Winter Hamfest. High School, Rt. 7. Mitch Stern W1SJ, 802-879-6589. E-Mail: w1sj@arrl.net Web: http://www.ranv.together.com

FEBRUARY 27

FL - ZEPHYRHILLS - Hamfest. Zephyrhills ARC, Ernie Vanselow KD4VRV, 813-783-8389
E-Mail: kd4vrv@gte.net
VA - ANNANDALE - Hamfest. Vienna Wireless Society, Mike Toia K3MT, 703-757-7021.
E-Mail: k3mt@erols.com
Web: http://www.erols.com/k3mt/vws

MARCH 2000

MARCH 4

NJ - PARSIPPANY - Hamfest. Splitrock ARA,

We've Got It!
MCM Electronics®

Prices effective November 15, through December 31, 1999.

To take advantage of special pricing on the items listed, please provide this code: **NVM28**

For over 20 years, MCM has been the leading supplier to the electronics service industry. Huge inventory, rapid delivery and competitive prices have made MCM the choice for:

- ***Hobbyists***
- ***Educators***
- ***Service Technicians***
- ***Installers***

5" Aluminum Cone Musical Instrument Speaker

MCM AUDIO SELECT™

Lightweight aluminum cone provides clean low frequency response with great ability to reproduce mid frequencies.
Specifications: •Power capacity: 50W/71W RMS/peak •Frequency response: 98Hz~15KHz •Impedance: 8ohm **•Reg. $9.49**

Order # 55-1291 $6.85

100 Watt Subwoofer Amplifier Module

MCM AUDIO SELECT™

Speaker level inputs, with satellite outputs and line level inputs, allow integration with virtually any system. Internally, this amplifier isolates, then sums the left and right inputs to give a single mono channel with 100W RMS output into a 4ohm load (85W RMS @ 8ohm).
Specifications: •Power requirements: 120VAC, 120W, 60Hz •Overall dimensions: 9⅞" (W) x 9¾" (H) x 5" (D)

Order # 50-6265 $99.95

Multi Voltage Regulated Power Supply

•Fully regulated to deliver constant DC power •Rotary selector switch selects 3, 4½, 6, 7½, 9 and 12V •Power projects or small battery operated devices **•Reg. $16.95**

Order # 28-2200 $9.95

Heavy-Duty Aluminum Tool Case Designed For Rough Field Use

Clarke

•Made of lightweight durable aluminum •Two inside panels and adjustable compartments easily carry hand tools, small soldering equipment, hand held test equipment and more •Measures 19" x 14" x 6" **•Reg. $51.50**

Order # 21-3460 $34.95

Round Hole Cuter with Adjustable Radius Blade

When attached to an electric drill, this innovative hole cutter will cut holes from 1¼"~7¾" diameter. Cuts plywood, plaster board and acrylic sheet up to 1¾" thick. Also cuts aluminum, brass and metal sheets up to .04" thick. Transparent cowl helps protect the user from flying chips.
Reg. $103.00.

Order # 22-1625 $74.50

Micro Board Camera

DEFENDER

Measures only 1¼" x 1¼" x 1". Features a ½" CCD image device producing over 380 lines of resolution. The built-in 3.6mm lens has a viewing angle of 92°. Input voltage: 12VDC, 330mA. Output: 1V p-p, 75ohm. **Reg. $64.95.**

Order # 82-2990 $49.50

12V 4.5Ah Sealed Lead Acid Battery

Ideal for use with alarm panels. Dimensions: 3⅜" x 2¾" x 4¼", 12VDC, 4.5Ah. Quick disconnect type terminals, ¼". **Reg. $26.95**

Order # 29-1335 $14.50

Regulated 13.8VDC Power Supply

TENMA

•10A continuous –14A surge •13.8VDC ±1% regulated output •High surge current capacity •Short circuit and overload protection •6¼" (W) x 4⅞" (H) x 10⅜" (D)

Order # 72-6623 $64.95

True RMS PC Interface DMM

TENMA 1 YEAR LIMITED WARRANTY

Features: •3¾ digit, 4000 count LCD display with three sub-displays and bargraph •True RMS •Resistance Capacitance •Temperature •Frequency counter •Transistor gain •Logic test (TTL and CMOS) •Square wave generator •Diode test •Continuity beeper •RS-232 communication •Data hold •Peak hold •Record/recall function •MIN/MAX/AVG •Relative mode •Compare mode •Includes test leads with alligator clips, temperature probe with transition, holster and owners manual

Order # 72-6685 $129.00

Power Inverter

Whistler

Provides 110VAC power from 12VDC. **Features include:** High surge capacity, high and low voltage protection circuitry, short circuit protection, overload protection, 3 prong AC outlet receptacles. Power requirements: DC to AC inverters require high amperage DC power to operate properly. High amperage power input cables are required and must be purchased separately for PP500AC, PP1000AC, PP1500AC and PP2500AC. 5.2" (W) x 2" (H) x 6.3" (L).

Order # 72-6452 $79.95

Order #	Outlets	Cont	Surge	Reg.
72-6452	2	300W	600W	$129.00

Open Air Type Stereo Headphones

PRO-LUXE

•40mm super thin diaphragm drive units •32ohm •Frequency response: 20Hz~20KHz •Sensitivity: 102dB SPL at 1KHz ± 2% •9' straight cord •Gold plated 3.5mm stereo phone plug •Gold plated 3.5mm to ¼" adaptor included **•Reg. $13.95**

Order # 35-450 $9.95

Stereo Cable Convertor

Emerson.

This convertor is a 181 channel MTS/SAP stereo cable convertor with volume control and remote. 181 channel capability includes 69 off air channels and 125 cable television channels. **Features include:** Microprocessor PLL operation, volume control, sleep timer, unlimited favorite channel memory, pass code protected parental controls and stereo audio/video output. Mfr. #ECC 1450

Order # 35-4910 $99.95

Audio/Video Modulator

•Accepts input from camcorder, VCR, computer and more •Converts signal to RF •Accepts composite video and line level audio via RCA jack •Output via female "F" connector •Channel 3 or 4 switchable •Power requirements: 117VAC, 60Hz •Dimensions: 3¼" (W) x 1⅛" (H) x 4½" (D)

Order # 33-1480 $19.95

FREE Literature

Same Day Shipping!
In stock orders received by 5:00 p.m. (YOUR TIME), are shipped the same day.

For complete ordering information on the items listed, or a free catalog, Call...

MCM ELECTRONICS®
650 CONGRESS PARK DR.
CENTERVILLE, OH 45459
A PREMIER FARNELL Company

1-800-543-4330

Secured ordering at: **www.mcmelectronics.com**

SOURCE CODE: NVM28

Write in 158 on Reader Service Card.

Events CALENDAR

Peter Glenn KC2KI, 732-457-4342 or 973-442-0772. E-Mail: peteg@interactive.net

MARCH 4-5

FL - NEW PORT RICHEY - Hamfest. Gulf Coast ARC, Rickie Brown KF4GXS, 727-863-1457. E-Mail: richar@gte.net. Don KK4VK, 727-848-8000. Web: http://homel.gte.net/koerner/gcarc.htm

MARCH 5

NY - LINDENHURST - Hamfest. GSBARC & SCRC, Lenore N2KYP, 516-785-0826. E-Mail: info@gsbarc.org Web: http://www.gsbarc.org

MARCH 10-11

NE - NORFOLK - State Convention. Elkhorn Valley ARC, Fred Wiebelhaus N0VLX, 402-379-1929. E-Mail: dfwiebel@sufia.net

MARCH 11

WA - PUYALLUP - Hamfest. Mike & Key ARC, Michael Dinkelman N7WA, 253-631-3756 or 425-867-4797. E-Mail: mwdink@eskimo.com

MARCH 11-12

NC - CHARLOTTE - Charlotte Hamfest and Computerfair. Charlotte Merchandise Mart, 2500 E. Independence Blvd. Mecklenburg Amateur Radio Society, Tom Hunt KA3VVJ, 704-948-7373 until 9pm EST. E-Mail: dealers@w4bfb.org Web: www.w4bfb.org/hamfest.html

MARCH 12

PA - YORK - Hamfest. Keystone VHF Club, Dick Goodman WA3USG, 717-697-2353. E-Mail: wa3usg@compuserve.com Web: http://members.aol.com/yorkfest

WI - WAUKESHA - Hamfest. County Expo Center, N.1 W.24848 N. View Rd. 8am-2pm. Talk-in: 146.820 PL 127.3. SEWFARS ARC, John Breecher, 414-835-7035

MARCH 17-18

GA - MARIETTA - Hamfest. Kennehoochee ARC, Charles Golsen N4TZM, 404-252-3303. E-Mail: cgolsen@atlanta.com

MARCH 18

FL - STUART - Hamfest. Martin County ARA, Romund Madson KS4KM, 561-337-1841

NJ - NORTH HUNTERDON - Hamfest. Cherryville Repeater Assn., Marty Grozinski W2CG, 908-788-2644 or 908-730-2771. E-Mail: w2cg@arrl.net

WV - CHARLESTON - Hamfest. Jimmie Hewlett WD8MKS, 304-768-1142

MARCH 18-19

TX - MIDLAND - West Texas ARRL Section Convention. Midland County Exhibit Bldg. Sat: 8am-5pm, Sun: 8am-2pm. VE Exams. Beverly Harwood KC5BNT, 915-686-1841. E-Mail: shamrock@apex2000.net, Web: http://www.lxnet/edge/midswap.htm. Larry Nix N5TQU, E-Mail: oilman@lx.net Web: http://www.w5qgg.org

MARCH 19

OH - MAUMEE - Hamfest. Lucas County Recreation Center, 2901 Key St. 8am-2pm. Talk-in: 147.27+ or 442.85+. Toledo Mobile RA, Paul Hanslik, 419-385-5056. Web: www.tmrahamradio.org

MARCH 24-25

OK - TULSA - West Gulf Division Convention. Green Country Hamfest Assn., Merlin Griffin WB5OSM, 918-622-2277. E-Mail: megriffin@ionet.net Web: http://www.greencountryhamfest.org

MARCH 25

WV - BECKLEY - Hamfest. Plateau ARA & Black Diamond RC, James Martin KC8JSZ, 304-465-1428. E-Mail: w373@ientone.net Web: http://members.spree.com/sip1/plateau

MARCH 25-26

MD - TIMONIUM - Greater Baltimore Hamboree & Computerfest/MD State ARRL Convention. Timonium Fairgrounds, York Rd. Sat: 8am-5pm, Sun: 8am-4pm. VE Exams. Baltimore ARC, Sharon Dobson N3QQC, 410-HAM-FEST or 800-HAM-FEST. E-Mail: n3qqc@amsat.org Web: http://www.gbhc.org

MARCH 26

OH - MADISON - Hamfest. Lake County ARA, Roxanne N8BC, 440-209-8953. E-Mail: tbrown@ncweb.com

APRIL 2000

APRIL 1

MO - LEBANON - Hamfest. Lebanon ARC, Micki Jensen KC0EEX, 417-588-2335. E-Mail: mjensen@llion.org

TX - BRENHAM - Hamfest. Brenham ARC, Dan Lakenmacher N5UNU, 409-836-8739. E-Mail: lindan@phoenix.net

APRIL 2

CT - SOUTHINGTON - Hamfest. Southington ARC, Chet Bacon KA1ILH, 860-628-9346. E-Mail: chet@chetbacon.com Web: http://www.chetbacon.com/sara.html

NC - KINSTON - Hamfest. Down East Hamfest Assn., Doug Burt W4OFO, 252-524-5724

APRIL 7-8

WI - MILWAUKEE - Hamfest. Amateur Electronic Supply, Ray Grenier K9KHW, 414-358-4088. E-Mail: rayk9khw@aol.com Web: http://www.aes/jam.com

APRIL 8

TN - CLINTON - Hamfest. Oak Ridge ARC, David Bower K4PZT, 865-690-8360. E-Mail: d.bower@ieee.org Web: http://www.korrnet.org/orarc

WA - SPOKANE - Hamfest. Lilac City ARC, Warren Kelsey KJ7BB, 509-534-8443

APRIL 9

NC - RALEIGH - State Convention. Raleigh ARC, Chuck Littlewood K4HF, 919-872-6555. E-Mail: k4hf@arrl.net Web: http://www.rars.org

PA - MONROEVILLE - Hamfest. Two Rivers ARC, Michael Kowalcheck KV3L, 412-751-9657. E-Mail: w3oc@nb.net Web: http://www.qsl.net/w3oc

WI - STOUGHTON - Hamfest. Madison Area Repeater Assn., Paul Toussaint N9VWH, 608-245-8890. E-Mail: n9vwh@arrl.net

APRIL 14-15-16

CA - VISALIA - International DX Convention. Southern CA DX Club, Cathy Gardenias KF6LFB, 909-862-0720. E-Mail: wu6d@dreamsoft.com Web: http://www.scdxc.org

APRIL 15

AL - ALBERTVILLE - Hamfest. Marshall County ARC, Buddy Smith KC4URL, 256-593-2516. E-Mail: kc4url@airnet.net

MN - BLAINE - Hamfest. Robbinsdale ARC, Harriet Johanson KB0UPG, 612-474-7346

NC - MORGANTON - Hamfest. Tom Taylor KC4QPR, 828-433-6205. E-Mail: kc4qpr@vistatech.net Web: http://www.wp.cc.nc.us/~cvhamfest/

APRIL 16

MA - CAMBRIDGE - Flea at MIT. Albany and Main Sts. 9am-2pm. Talk-in: 146.52 & 449.725/444.725 W1XM/R PL 114.8 (2A). Nick

End of MILLENNIUM SALE on Our Best Soldering & Desoldering Tools

DEN-ON SC7000Z Desoldering Tool Guaranteed to be the **BEST** Transportable Desoldering Tool you will ever own. **Base Station Performance** in a Portable Tool. Very High and Quick Vacuum. Quick cleaning filter.

10% off of our Nationally Advertised Price of $395

For a Very Limited Time

$355.50

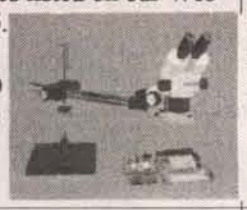
Inspect your SMD work with the **Stereo Zoom Microscope from Scienscope.** Add different eyepieces and auxiliary lens to get various Magnifications, field of views, and large working distances. Several microscopes listed on our Web site as low as $495.

GL-CO-PK4

Regular Price $1364.00

Millennium Price

$1245.60



DEN-ON SS-8200 Temperature Controlled Soldering Pencil is a hit with everybody who ventures to try it. It is small, lightweight, easy to use, temperature controlled, and has a burn proof cord and long lasting tips. It also has a **200W Ceramic Element** that keeps it at a constant temperature. Check picture and specs. on our Web Site.

Special Millennium Price $95.00

The **Best Hot Air Tool** Available. Check out the specifications on our Web Site. Temperature controlled from 120°F to 1100°F. Variable speed motor. Hot & Cool switch. LCD Readout for Temperature.

Regular price $182.00

Now $163.80

EDSYN's 951SX Industrial Grade Temperature Controlled Soldering Station is by far their most popular Soldering Station. Sold nationally for as much as $164.95.

Our Special Price $99.00

EDSYN's ZD906 includes a **Desoldering Tool**, a **Soldering Pencil** and a **Hot Air Pencil.** Shop air is required. Very small footprint required on your bench. Check out the Specs on our Web Site. 18 Month Warranty

Regular price $1179.00

Save 10% from our low price

$1061.10

Very **REDUCED** Price on the **EDSYN ZD500DX. Save $200.00** on one of the Best Industrial Grade Desoldering Stations available. Completely made in the USA by skilled USA workers. 18 Month Warranty.

Was $749.95

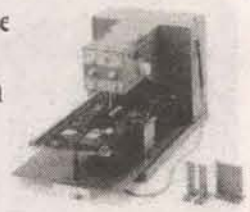
Now $549.95

Contract Manufacturers This instrument was made for you. Check out the specs. on our web site. **Free Trials Available**. Advertised Nationally for $5000.

Our Regular Price $4500.00

Millennium PRICE

$4250.00



New Product from EDSYN 971HA SMT Hot Air Station

Precise adjustment for heat and air flow. Air automatically shuts off when pencil is placed in holder. Excellent for SMD work up to 80 pins. Easily converts to Powerful Solder Station w/large selection of tips.

Our Regular Price $599.00

Now $539.10

Capacitor Wizard ESR Meter

Will be on sale for a **Limited Time Only Must Mention this Ad**

Regular Price $179.95

Now $159.95

Inexpensive but Functional EDSYN Fume Extractor Fans

Uses solder spool for counter balance. Quiet, Efficient and Space Saving. **FXF-11** or **FXF-12** **$115.00**

PDR/Xytronic 710 SolderLight

IR Component Heating w/**IR** Hand tool

IR PCB Preheating W/Bottom Heater

All types SMD's and BGA's See Web Site for Specs.

Millennium Madness

$2395.00

www.howardelectronics.com

Visa - M/C - Discover - A/E - COD - Terms to Qualifying Companies

30 Day Money Back Total Satisfaction Guarantee

HOWARD ELECTRONIC INSTRUMENTS INC

Your Desoldering Specialists

Toll Free U.S. and Canada 1-800-394-1984

www.howardelectronics.com

sales@howardelectronics.com

International (316) 744-1993

or Fax (316) 744-1994

Events CALENDAR

Altenbernd KA1MQX, 617-253-3776 (9-5). Web: http://web.mit.edu/w1mx/www/swapfest.html
MI - GROSSE POINTE - Hamfest. South Eastern MI ARA, Jerry Rosner N8FGK, 313-331-3336. E-Mail: n8fgk@amsat.org Web: http://members.home.net/semara

APRIL 21-22

AR - LITTLE ROCK - Little Rock Hamfest, Jim Blackmon K5VZ, 870-246-7833 (h) or 870-246-6734 (w). Fax: 870-246-6736. E-Mail: lrhamfest@usa.net Web: http://www.aristotle.net/~ares/hamfest/

APRIL 22

ID - IDAHO FALLS - Hamfest. Eastern ID UHF Society, Jay Greenberg WA4VRV, 208-524-1388 or 208-526-7033. E-Mail: wa4vrv@srv.net Web: http://www.srv.net/~wa4vrv/hamfest.htm
NH - NASHUA - Hamfest. Res Ctr Church. NE Antique RC 617-923-2665

APRIL 29

AL - MOULTON - Hamfest. Bankhead ARC, Rex Free KN4CI, 256-905-0822. Web: http://www.homestead.com/n4idx
IA - DES MOINES - Hamfest. Des Moines RAA, Duane Bower WB0UCY, 515-287-6542. E-Mail: duaneab@uswest.net

MAY 2000

MAY 6

WI - CEDARBURG - Hamfest. Ozaukee RC, Joe Holly AA9HR, 262-377-2137; E-Mail: aa9hr@execpc.com. Skip Douglas, 262-284-3271

MAY 6-7

AL - BIRMINGHAM - Hamfest. Glenn Glass KE4YZK, 205-681-5019. E-Mail: ke4yzk@bellsouth.net Web: http://www.bro.net/barc/slideshow/index.html

MAY 7

MD - HAGERSTOWN - Hamfest. Antietam Radio Assn., Tina Jones KB8ZQM, 304-728-7769. E-Mail: kb8zqm@intrepid.net Web: http://www.qsl.net/w3cwc
NY - YONKERS - Flea Market. Lincoln High School, Kneeland Ave. 9am-3pm. VE Exams. Talk-in: 440.425 PL 156.7, 223.760 PL 67.0, 146.910, 443.350 PL 156.7. Metro 70cm Network, Otto Supliski WB2SLQ, 914-969-1053. E-Mail: wb2slq@juno.com Web: http://www.metro70cmnetwork.com

MAY 12-13

NH - ROCHESTER - Hamfest. Fairgrounds. Hoss Traders, Joe, 207-469-3492

MAY 19-20-21

OH - DAYTON - ARRL National Convention. Dayton ARA, Dave Coons, WT8W, 937-849-0604. E-Mail: wt8w@arrl.org Web: http://www.hamvention.org

MAY 21

MA - CAMBRIDGE - Flea at MIT. Albany and Main Sts. 9am-2pm. Talk-in: 146.52 & 449.725/444.725 W1XM/R PL 114.8 (2A). Nick Altenbernd KA1MQX, 617-253-3776 (9-5). Web: http://web.mit.edu/w1mx/www/swapfest.html

MAY 27-28

WY - CASPER - State Convention. Casper ARC, Warren (Rev) Morton WS7W, 307-235-2799 or 307-237-9301. E-Mail: mortonwg@aol.com Web: http://w3.trib.com/~carc/hamfest.html

JUNE 2000

JUNE 2-3-4

NY - ROCHESTER - Atlantic Division ARRL Convention. Harold Smith K2HC, 716-424-7184. E-Mail: rochfst@frontiernet.net Web: http://www.rochesterhamfest.org

JUNE 3-4

OR - SEASIDE - Northwestern Division ARRL Convention. Convention Center. VE testing. Talk-in: 146.660 (-600). SEAPAC, Randy Stimson KZ7T, 503-297-1175. Web: www.seapac.org

JUNE 4

IL - PRINCETON - Hamfest. Starved Rock Radio Club, Alan Erbrederis N9PIB, 815-498-9675. E-Mail: w9mks@arrl.net Web: http://www.qsl.net/w9mks
VA - MANASSAS - Hamfest. Ole Virginia Hams ARC, Jack McDermott N4YIC, 703-330-7987. E-Mail: N4YIC@arrl.net or patnjack@erols.com Web: http://www.qsl.net/olevahams/

JUNE 10

NC - WINSTON-SALEM - Hamfest. Forsyth ARC, John Kippe N0KTY, 336-723-7388. Web: http://members.xoom.com/w4nc/hamfest.htm
PA - BLOOMSBURG - Eastern PA Section Convention. Columbia-Montour ARC, George Law N3KYZ, 570-784-2299. E-Mail: n3kyz@epix.net Web: http://www.bafn.org/~cmarc

JUNE 11

IL - WHEATON - Hamfest. Six Meter Club of Chicago, Joseph Gutwein WA9RIJ, 630-963-4922 or 708-442-4961. E-Mail: wa9rij@mc.net Web: http://cyberconnect.com/orion/smcc.html
TN - KNOXVILLE - Hamfest. RAC of Knoxville, David Bower K4PZT, 423-670-1503. E-Mail: rack@korrnet.org Web: http://www.korrnet.org/rack

JUNE 18

MA - CAMBRIDGE - Flea at MIT. Albany and Main Sts. 9am-2pm. Talk-in: 146.52 & 449.725/444.725 W1XM/R PL 114.8 (2A). Nick Altenbernd KA1MQX, 617-253-3776 (9-5). Web: http://web.mit.edu/w1mx/www/swapfest.html

JULY 2000

JULY 2

PA - WILKES-BARRE - Hamfest. Murgas ARC, Stanley Perry KE3TC, 570-735-2385. E-Mail: slperry@epix.net

JULY 7-8-9

UT - BRYCE CANYON - State Convention. UT Hamfest Committee, Kathy Rudnicki N7JSH, 801-547-9218

JULY 8

GA - GAINESVILLE - State Convention. Lanierland ARC, Ken Johnson NZ4Q, 706-335-9658. E-Mail: nz4q@aol.com
MO - KANSAS CITY - Hamfest. PHD ARA, Bob Roske WA0CLR, 816-436-0069. E-Mail: wa0clr@worldnet.att.net Web: http://members.tripod.com/~PHDARA/

JULY 9

IL - PEOTONE - Hamfest. Kankakee Area Radio Society, Don Kerouac K9NR, 815-939-7548. E-Mail: k9nr@juno.com Web: http://www.w9az.com

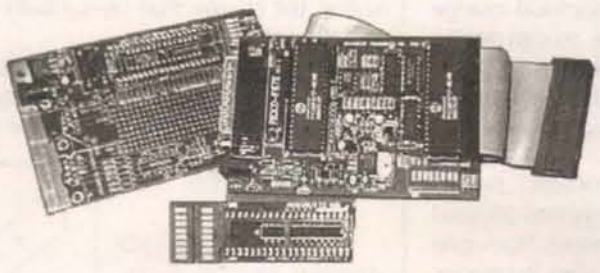
JULY 16

MA - CAMBRIDGE - Flea at MIT. Albany and Main Sts. 9am-2pm. Talk-in: 146.52 &

Continued on page 72

PIC Real-time 'Emulator' and Programmer for $159

Introducing PIC-ICD = Debugger + Programmer + Demo Board = $159



Hear this ...

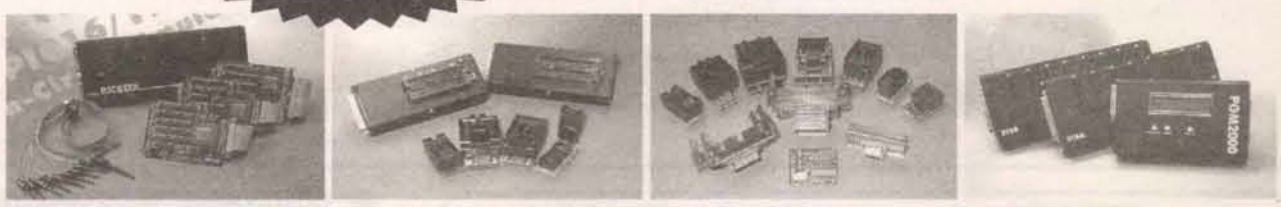
"Impressed with both the technical performance of the emulator and the cooperative attitude of the company personal. I will recommend your products to others" - DJ Caldwell, CA

"Great product with excellent support!" - K M Bowers, NC

"Unprecedented customer service" - R Thomas, NC

- For PIC16F87X and emulates most PIC16C6X/7X
- In-circuit run-time debugging
- Real-time code execution
- High speed parallel port interface
- Built-in device programmer
- 2.5V to 6.0V operating range
- One level real-time breakpoint
- Two external break inputs
- Conditional animation break
- Run, step, run to Cursor, etc.
- Operating frequencies from 32khz to 20mhz
- Runs under PICICD IDE (Win 95/98/NT) or MPLAB™ (Win 95/98)
- Source level and symbolic debugging
- Software animation trace captures 3 user-defined variables in addition to opcode, W, STATUS, FSR registers and corresponding instructions
- Comes with ICD Debug module, demo board, 40-pin and 28-pin emulator headers, cable, power adapter, IDE software and printed user's guide

New Low Prices Best Value



RICE17A Emulator System now from $599 to $700

- 64K program memory
- 32K real-time trace
- 12-clip external probe - break input, break output, trigger output, 8 logic traces and ground
- Source level debugging
- Unlimited software breakpoints and trigger points
- New PB-877 and PB-77X probew provide data breakpoint (Jan 2000)
- Supports PIC12/16/17
- Low voltage emulation
- Self-diagnostic test board

Single Socket PIC Programmers and Adapters

- PGM16N supports all PIC12/14/16
- PGM17 supports all PIC17
- One 40-pin ZIF socket for all DIP parts
- Optional surface mount sockets for all package types which are compatible with all PIC programmers
- Emulation headers in SOIC, PLCC and QFP packages
- Win 95/98/NT hosting software
- DOS software for PGM17
- Compact and portable

Stand Alone Gang Programmer from $900

- New flash based firmware makes new device support a snap
- Production quality 8-gang programmer for PIC, SX, ST6 and more
- Approved by IC manufacturers
- Stand-alone chip duplication
- LCD and LEDs display program functions and results
- Codes reside securely in EEPROM of control module
- Custom all programming voltages in 0.1v increments

Advanced TransdAtA CORPORATION
14330 Midway, #128, Dallas, Texas
Tel 972.980.2667 Fax 972.980.2937
Email: atc1@ix.netcom.com

Visit the Ultimate Source for PIC Tools at

www.adv-transdata.com

Write in 61 on Reader Service Card.

by Joseph J. Carr

Open Channel

Electrostatic Discharge (ESD)

This month, let's talk a little about electrostatic discharge. It is very important in electronics, especially where MOSFET or CMOS devices are in use (other components are ESD sensitive, as well).

The fundamental aspect of matter that permits the flow of electricity is the existence of free electrons in that matter. The electrical resistance of a material is defined by how many free electrons exist in the material. Metals, for example, have many free electrons so it is relatively easy to generate a current flow in them. Insulators, on the other hand, have few free electrons so current flow is proportionally lower. An attribute of insulators is that they do not allow redistribution of electrical charge across their entire surface, so can permit local electrical charge to build up. This is static electricity, and leads to electrostatic discharge (ESD) damage to electronic devices.

Triboelectric generation results whenever sufficient energy has allowed the transfer of free electrons from one insulating material to another by means of contact or friction. Table 1 shows the triboelectric series, which is the electrostatic relationship between the items.

Materials on the top end of the chart have a greater tendency to lose electrons, so are considered "increasingly positive." Figure 1 shows what happens when wool is rubbed against hard rubber. Electrons are transferred from the wool to the rod. This occurs because the energy level of the valence electrons is raised to the point where they become free electrons, and can escape to the hard rubber rod.

Materials can be classified according to the surface resistance in ohms per square (ohms/sq). Table 2 shows the resistance of materials in ohms per square.

Metals and other conductors are not triboelectric generators because they can redistribute electrical charge received by rubbing over their entire surface, avoiding the local build-up of charge. Insulative materials can be charged by triboelectric generation.

The amount of moisture in the air is the humidity, and it can determine the amount of electrical charge that an object can hold. The air resistance can control this charge, and will "bleed off" electrostatic charge. This explains why electrostatic discharge (ESD) will occur more often in the winter time when the humidity is low and air resistance is high.

The threshold of feeling for electrostatic discharge is around 4,000 volts. Any potential below 4,000 volts cannot be felt, but is still dangerous to electronic equipment. If the static electric spark is heard, then it is in the range of 5,000 to 50,000 volts. It is quite possible for the human body to have an electrostatic charge of 35,000 volts! Table 3 shows the charge that can be built up by various activities.

This is compared with various electronic devices' electrostatic voltage tolerance of 30 to 7,000 volts (Table 4).

ESD Effects

The effects of ESD damage can be devastating to electronic equipment, but it is often misdiagnosed. This is due to the following:

1. Failures are analyzed as being due to electrical transients other than electrostatics.

2. Categorized by random, unknown, "manufacturing defects," or other causes.

Very few failure modes and effects laboratories are equipped with scanning electron microscopes needed to see the damage. Figure 2 shows two views of a MOSFET transistor with both non-damaged (Figure 2A) and damaged (Figure 2B) versions. Hard faults are immediate and catastrophic failures due to ESD, and are immediately apparent. The critical part of the MOSFET device is the thin dielectric insulator between the gate and the substrate/drain/source structure. If enough heat is generated by the static charge, then metallic ions will flow into the void created by the ESD, shorting the structure.

Far more devastating are the soft faults to electronic equipment. These faults do not appear immediately because the void (Figure 2B) is not filled with metal, but rather metal ions migrate into the space from the gate structure over time. Statistics indicate that 90 percent of all ESD may be this type. It is far harder to diagnose because it takes from 90 days to six months of operation to fill in the void, with nothing to show for it other than (possibly) reduced performance.

Identification by Class

Electronic components can be

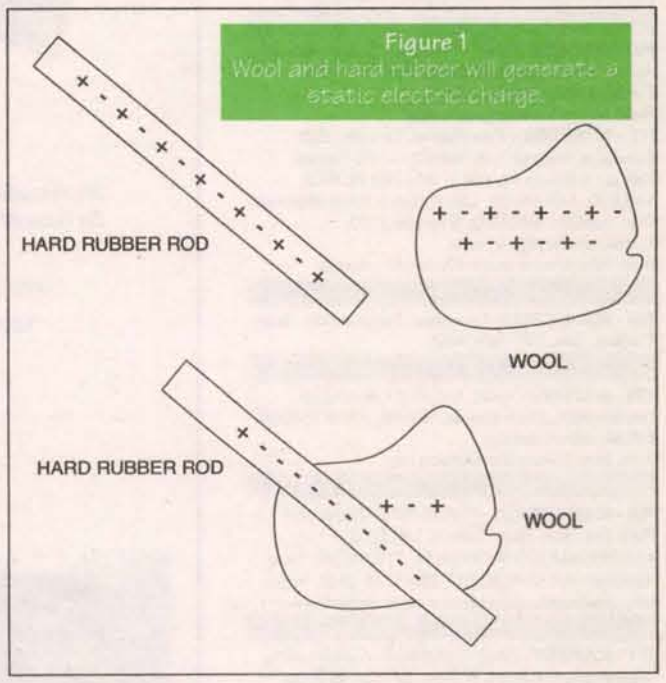


Figure 1
Wool and hard rubber will generate a static electric charge.

EPROM+
A device programming system for design, repair and field service
◆ EXCEPTIONAL POWER FOR THE PRO
◆ EASY-TO-USE FOR THE NOVICE

Here's what you get: A rugged, portable programming unit including the power pack and printer port cable both of which store inside the case. A real printed user and technical manual which includes schematic diagrams for the programming unit plus diagrams for all technology family adapters*. Comprehensive, easy-to-use software which is specifically designed to run under DOS, Windows 3.1, 95 and 98 on any speed machine. The software has features which let you **READ**, **PROGRAM**, **COPY** and **COMPARE** plus much more. You have full access to your system's disk including **LOADING** and **SAVING** chip data plus automatic processing of **INTEL HEX**, **MOTOROLA S-RECORD** and **BINARY** files. For detailed work the system software provides a full screen buffer editor including a comprehensive bit and byte tool kit with more than 20 functions

Broad device support: Including **FIRST GENERATION EPROMS** (2708, TMS2716*, 25XX etc.) **SECOND GENERATION EPROMS** (2716-27C080)(8 MEG), **40 and 42 PIN EPROMS*** (27C1024-27C160)(16 MEG) **EEPROMS** (2816-28C010) PLUS **ER5901**, **FLASH EPROMS** (28F,29C,29EE,29F)(32 MEG), **NVRAMS** (12,20,X2210/12) **8 PIN SERIAL EEPROMS*** (24 ,25 ,85, 93, 95, 80011A) PLUS **ER1400/M58657*** **BIPOLAR PROMS*** (74S/82S), **SERIAL FPGA CONFIGURATORS** (17CXXX) **MICROS*** (874X,875X,87C5X,87C75X,89C) **ATMEL MICROS***(89S,90S)(AVR) **PIC MICROS*** 8, 18, 28, 40 PIN (12CXXX,16C5X,6X,7X,8X PLUS FLASH & 17C) **MOTOROLA MICROS*** (6870SP3/U3/R3, 68HC705C8/C9/J2/P9, 68HC711E9/D3)

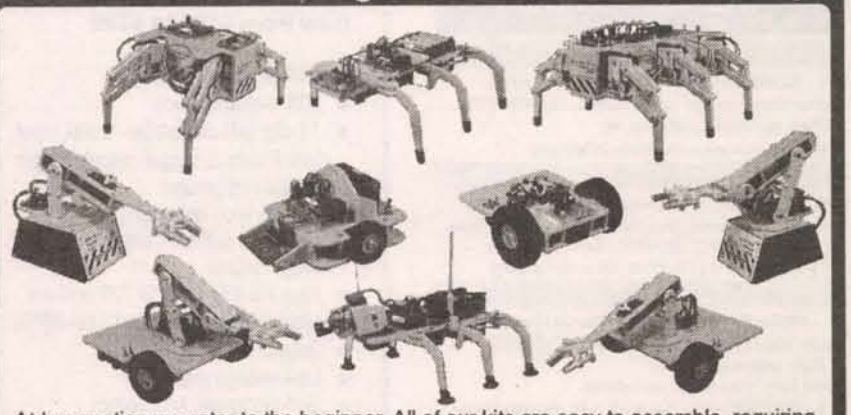
$289

☐ Includes step-by-step tutorial plus explanation of EPROM fundamentals
☐ 1 YEAR WARRANTY - 30 DAY MONEY BACK GUARANTEE
*REQUIRES SNAP-IN ADAPTER (ORDER FACTORY DIRECT OR BUILD YOURSELF)

$5.00 SHIPPING - $5.00 C.O.D.
VISA • MASTERCARD • AMEX

ANDROMEDA RESEARCH, P.O. BOX 222, MILFORD, OHIO 45150
(513) 831-9708 FAX (513) 831-7562
website - www.arlabs.com email - arlabs@worldnet.att.net MADE IN THE U.S.A.

Build Your Own Intelligent Robot, We Make It Easy!



At Lynxmotion we cater to the beginner. All of our kits are easy to assemble, requiring only common hand tools in the construction process. The detailed assembly manuals include 2D and 3D exploded view diagrams. The kits can be controlled or programmed in an easy to follow BASIC programming language. The technology is here, the costs are affordable, the support is available, join in and become a robot builder!

Lynxmotion, Inc.
104 Partridge Road
Pekin, IL 61554-1403
www.lynxmotion.com

Lynxmotion
Visit our website or ask for our free catalog!

Tel: 309-382-1816
Fax: 309-382-1254
sales@lynxmotion.com
tech@lynxmotion.com

Write In 73 on Reader Service Card.

classified according to electrostatic discharge capability. Class-1 is the most sensitive, class-2 is less sensitive, and class-3 is the least sensitive. Obviously, class-1 includes MOSFETs and JFETs, or anything on the list that has susceptibility less than 1,000 volts. Class-2 devices have a sensitivity range of 1,000 to 4,000 volts, and class-3 devices have a sensitivity range of 4,000 to 15,000 volts.

ESD Control Procedures

The key to a good program for controlling ESD is found in creating an environment that is protected against generating static electricity. The environment must consider things such as floors, workbenches, materials, equipment, and operating procedures. At the very least, one must equip the technicians and other workers with electrostatic wrist straps, a portable protective work mat, and protection for the parts being placed into the equipment. A manufacturing facility may include an elaborate grounded workbench made of ESD protective materials, humidity controls, conductive flooring, and air ionizers, in addition to the above.

An Electrostatic Location Meter will help you determine whether or not static has built up. You can sense voltages from 500 to 50,000 volts with these instruments, depending on the model.

In the discussion below, the terms "hard ground" and "soft ground" will be used. The term hard ground means that the item is connected to ground through copper or aluminum wiring, while the term soft ground means that it is through a resistance.

Work Areas

The work area should be controlled access, which means that people should be kept out unless they are trained. At the least, protect an area approximately one meter surrounding the work area. The following should be avoided:

- No tapes (3M Magic, masking), except where installed and removed under controlled ionization.
- No vinyl-covered notebooks or instruction folders.
- No telephones, unless designed for the area.
- No plastic note holders, pen holders, calendar holders.
- No plastic cased vacuum cleaners or heat guns.
- No unapproved soldering irons.
- No unapproved solder suckers.

Protective Flooring

Floors are very important in protecting against ESD damage. Only use conductive, static dissipative floors, anti-static carpeting, conductive vinyl, or terrazzo floor tiles. When vinyl tiles are used, the adhesive should be conductive, also. Use conductive wax on floors, or leave them un-waxed. Static charge builds up on normal wax.

Painted or sealed concrete floors or finished wood floors should be covered with ESD floor mats. Or treat them with a topical anti-static compound if no floor mats are available. In any event, the floor should be tested periodically to determine if it is still conductive.

Use of a grounded floor is not terribly useful if the individual worker is not soft grounded, also. Use conductive shoe covers, conductive shoes, heel grounders, or some similar devices to ground the body of the worker. Conductive work stools or chairs should also be used.

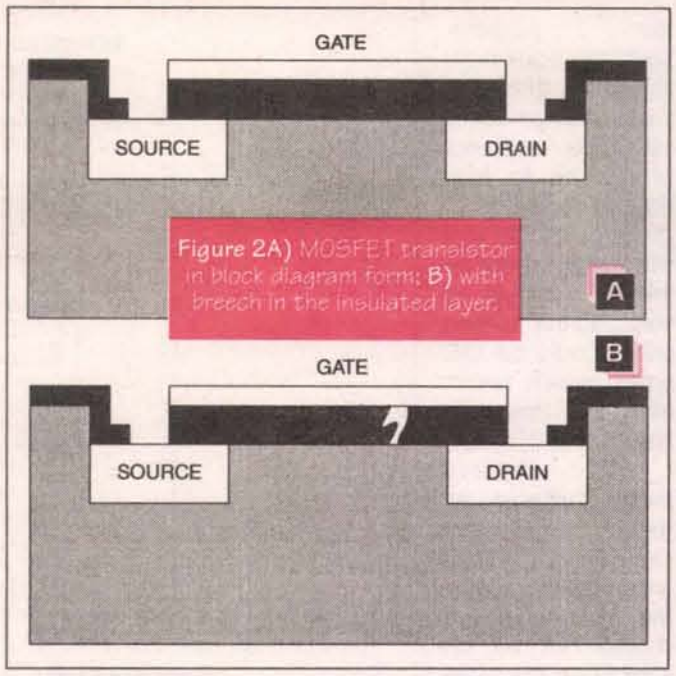


Figure 2A) MOSFET transistor in block diagram form; B) with breech in the insulated layer.

Workbenches

Figure 3 shows a workbench set up for ESD protection. It is set on conductive flooring or a conductive mat, and is made of conductive materials.

There is a protective wrist strap on the bench that grounds the worker. It should have a resistance that limits current flow to 5 mA – the threshold of perception – at the voltages that will be worked on the bench. For 240 volts, that means the resistance should be higher than 240/0.005 = 48,000 ohms.

Two types of ESD wrist straps are used: carbon impregnated plastic and insulated metal conductor. The carbon impregnated type distributes the resistance over its entire length, so it should be insulated to guard against touching hard grounds. The insulated metal conductor type contains a built-in resistor. The strap should include an alligator clip, or snap, or other form of quick disconnect to permit the user to disconnect in emergencies or when leaving the work area.

There is an ionizer and monitor on the bench in cases where manufacturing or very sensitive work is taking place.

Equipment

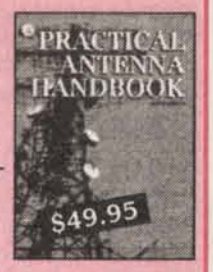
The equipment used on the ESD workbench should be designed for

2 Great Books
by Joseph Carr

SECRETS OF RF CIRCUIT DESIGN

From one of today's most respected electronics authors comes this pragmatic, intermediate-level guide to designing, building, and testing all types of radio frequency circuits. Filled with functional projects that demonstrate the principles of RF circuits, this revision of a bestseller also provides a handy parts list and sources of components.

PRACTICAL ANTENNA HANDBOOK



The most popular book on antennas ever written, widely known as "the antenna builder's bible."

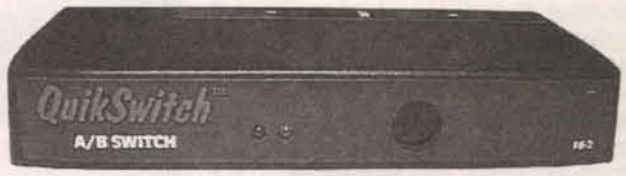
This *Third Edition* is a work for anyone with an interest in antennas, from the newest of novices to the most experienced engineer. This empowering book gives you all kinds of projects and material that explains why what you did works.

As a paid subscriber to *Nuts & Volts*, you'll receive **10%** off the list price!!

(See ad on page 48 for ordering details and other titles currently available.)

REMOTE CONTROL TV A/B SWITCH SHOWDOWN

VS.



- HAS SEPARATE REMOTE FOR A/B
- MUST PLUG INTO AN A.C. OUTLET
- HAS EASILY DAMAGED R.F. RELAY
- A TO B ISOLATION IS MARGINAL
- POOR R.F. SHIELDING, CAN CAUSE DIAGONAL LINES IN TV PICTURE

- CONTROLLED BY EXISTING TV REMOTES
- NO A.C., RUNS A FULL YEAR ON 2 "AA"s
- 100% SOLID STATE, NOTHING TO BREAK
- EXCEPTIONALLY HIGH A TO B ISOLATION
- EXCELLENT R.F. SHIELDING, WILL NOT CAUSE INTERFERENCE IN TV PICTURE

QuikSwitch blows away the competition, both in quality and convenience! With its patented infrared receiver, QuikSwitch gives virtually any TV/VCR/CABLE/SAT remote the power to switch between A & B video sources! Switching is accomplished simply by holding down any button on any infrared remote for 2 seconds. A button such as "0" or "STOP" is used, one that will be ignored by the TV/VCR/etc. QuikSwitch has bright red & green A/B indicators, and runs for a full year on 2 "AA" alkaline batteries (not included). No A.C. outlet needed! What's more, QuikSwitch is a top quality R.F. device, with exceptional immunity to crosstalk and signal leakage. Why would you buy any other A/B switch? Order your QuikSwitch now and save!

QUIKSWITCH SPECIAL! $19.95 3-$50 10-$140

Shipping Charges Additional - 30 Day Money Back Guarantee - One Year Warranty

VISA MasterCard

MILESTONE PRODUCTS 1-800-831-0184

D.T.M.F. DECODER

For interconnect and remote control applications

Model NC401

$59.95

The Model NC401 is a micro-miniature DTMF decoder, designed for selective control of local or remote applications. Measuring .80"Wx1.37"Lx.23"H, the NC401 combines three distinct, multi-addressing decoders offering multiple user-configurable functions. All programmed features are stored in non-volatile E2Prom memory and are easily programmed by means of a conventional DTMF encoder or the Model NC500 Universal/P.C. programmer. This highly engineered decoder is ideal for portable radio applications having limited space for accessories. The NC401 comes complete with micro-miniature 14 pin header and 12" color coded cable assembly.

Nor-fax Doc. #5545

VOICE SECURITY ENCRYPTION

Model NC802

$59.95

The Model NC802 is a miniature inversion scrambler designed to provide intermediate level security for two-way radio voice communication systems and is a perfect, cost-effective solution to entry-level voice scrambling as a defense against unauthorized or casual listeners. The NC802 provides eight user selectable carrier codes commonly used by other manufacturers and interfaces easily to most radios with near transparency to the user.

Nor-fax Doc. #5759

For Detailed Specifications or Product Catalog call our 24-Hour NorFax retrieval system at 530-477-8403 or on our Web Site at www.norcommcorp.com

NORCOMM™ DATA SIGNALLING PRODUCTS

800-874-8663

15385 Carrie Drive
Grass Valley, CA 95949 USA

the purpose. Soldering equipment should be three-wire types with grounded tips. The resistance of the tip to hard ground should be 20 ohms or less so that the voltage build-up will be less than 15 volts. Solder suckers used should be ESD types, which means at least they will have conductive tips.

All exposed metal surfaces on test equipment should be hard grounded. However, the test equipment should not be set directly on the workbench's conductive surfaces for fear of rendering the surface – and the person using the equipment – at hard ground potential. Ground fault interrupters should be used on all outlets on the workbench.

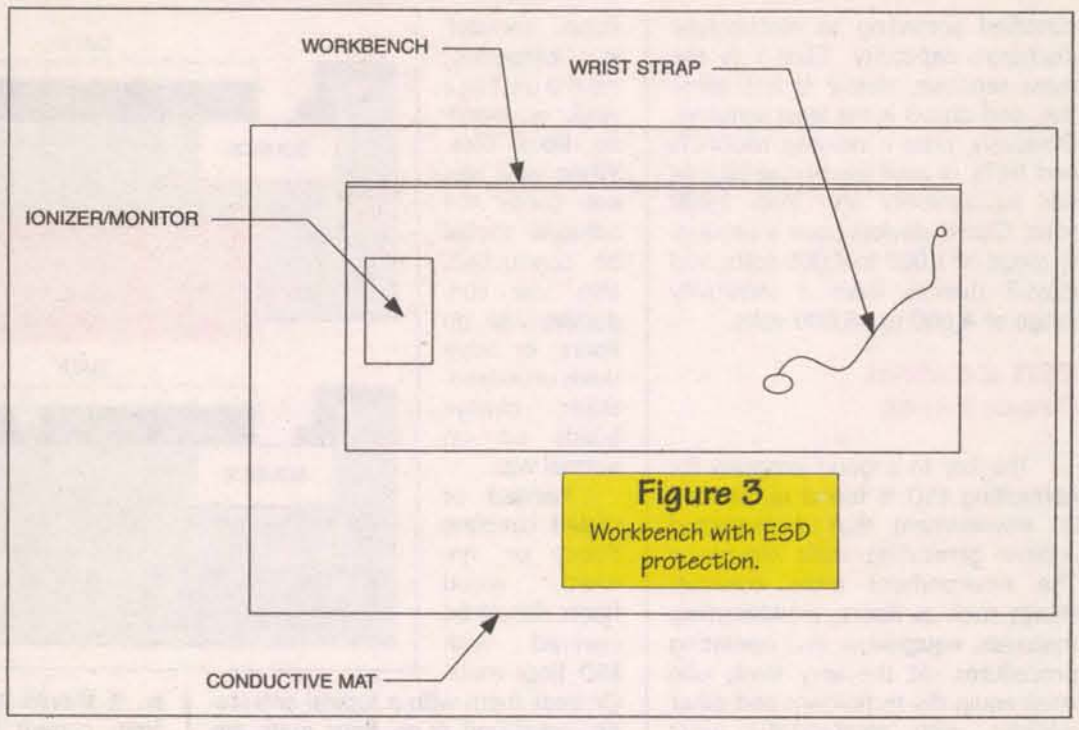


Figure 3
Workbench with ESD protection.

Clothing

People handling ESD sensitive electronic products should be properly attired to do so. They should wear long-sleeved ESD smocks or close fitting short sleeve shirts. The use of ESD protective aprons is encouraged. Never use smocks or gloves made of common, ordinary plastic as it is not ESD protective.

ESD Protective Materials

Protective materials should be used to protect electronic products containing ESD sensitive components. Chips should be mounted on those foam carriers and not removed until they are ready for use. The finished, printed circuit cards should be stored in ESD bags, wrappings, or boxes.

Conclusion

ESD protection is not a very difficult thing to do, and is so very important in electronics. It is a limited and low impact concept, so should be done whenever electronic gear is being serviced. **NV**

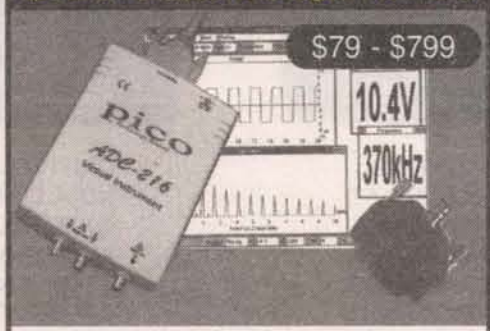
Connections ...

I can be reached by snail mail at P.O. Box 1099, Falls Church, VA 22041, or via E-Mail at CARRJJ@AOL.COM.

Happy Holidays

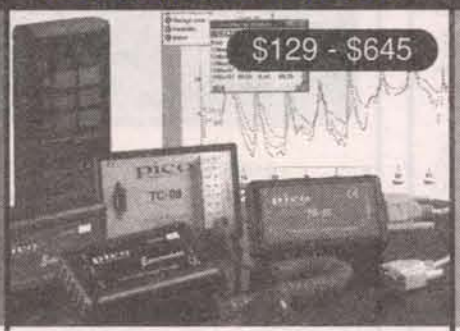
Use your PC as a scope and datalogger!

Parallel Port Scope
spectrum analyzer, and digital multimeter



ADC Virtual Instruments turn your PC or laptop into a sophisticated storage scope AND spectrum analyzer AND multimeter. Display simultaneously on large screen! 100MS/s 8-bit or 1.2MS/s 12-bit or 333kS/s versions. Great for schools, test depts, etc. Input to Excel! LabView/NT drivers included.

Environmental Logging
record temperature, humidity, etc.



ENVIROMON - temperature (thermistor), humidity & light sensors, door position, etc. Record for 365/24 without a PC even if power fails. Monitor 30 sensors 400 yds away. With cables and easy software. Remote audio alarm. Use **TC-08** for most thermocouples.

osziFOX
20MS/s handheld scope

osziFOX - handheld storage scope and DVM - stand-alone or plugs into your PC for display, store-to-disk, printing in color. Inputs to 100V, trigger, backlit LCD.

PC-based Instruments!

Download FREE demo software. Sales only: 1-888-7SAELIG

www.saelig.com 716-425-3753 • -3835 (fax) saelig@aol.com

pico Technology Limited ®

***Stocked in NY by Saelig Company:** Virtual Instruments, I2C and embedded controllers, BITlink 2-wire networks, RS232/422/485, frame grabbers, etc. See **www.saelig.com** for Product of the Month!*

SUPER CHRISTMAS FINANCING

Netcom #1 in Customer Service Since 1983

IBM ROAD WARRIOR
Professional Road Equipment

3 easy payments of $268
0% Financing! On Credit Cards only

MAXIMUM ABUSE
strictly for professionals

Blazing Sunlight or Rain Storm
On the DESERT or SNOW
Instant ON - ZERO boot up time
Drop 3' to Concrete

Rain: (4"/hr Rain w/ 40 MPH *Winds*)
Silicone Rubberized & Diecast Case !
Ultra Shock Mounted 1GIG EIDE Hard Drive !
ESD / EMF & RF Resistant, Works from -4 to 120 Deg F & Vacuum to 15,000 ft

Perfect for GPS Satellite Navigation
Actual Selling Price From IBM $6,912

- > 1- PCMCIA (type 1, 2 or 3), Serial & Parallel Ports in rear
- > 16m Ram / 1m Video / **32 Bit** Local Bus 486-50 Mhz & Math Co-processor, 28.8k Modem (Internet Ready)
- > Very Long Lasting Hydride Battery ($150 Value)
- > Sound & Microphone, External Mini 3.5 Floppy
- > 8.25" Display-64 Shade Monochrome REFLECTIVE
- > (Optional) Touch Screen *with* Handwriting Recognition

Rough Service Handle with Loops for optional Shoulder Strap
Roxanne's Voice Annotates all Windows 3.X Functions
OPTIONS
> W95 $89 > 12V Car cord $29
> Touch Screen $250 > 33k Baud PCMCIA Fax- Modem Upgrade $35

This was a unique (one shot) purchasing opportunity
IT'S NOT OPEN STOCK
WHEN THEY'RE GONE, THEY'RE GONE FOR GOOD
Sold till recently by IBM through their Local Area Network Div at $4,699 & $6,912 as shown here. (they were never discounted)

233 Mhz Pentium SubNotebook

4 Easy payments of Wow $249!
0% Financing! On Credit Cards only

3YR! WARRANTY **FREE Carry Case Till Christmas**

Looks so nice in person, it'll give ya Goose Bumps

Low Price / High Performance

233mhz	External CD 8" SVGA Color Display Built-in Stereo Speakers & Mic
3.2Gig	External Mini Floppy Convenient Touch Pad Mouse (excellent!)
32m ram	Lithium Ion battery 2 USB ports, IR Port, All standard ports on rear
56k modem	2 PCMCIA Ports Light-weight 3.3 lb 9.5 x 7 x 1.5 Built-in palm rests
CD 24x	One year Manufacturer Direct Warranty FREE Lifetime NetcomTech support
USB (2)	*OPTIONAL CUSTOM Carrying Case $24* SOYO Embossed LOGO, Tailored fit, Pockets, Handle & includes Shoulder Strap
W98	SOYO is the leading maker of Computer Motherboards for FAMOUS BRAND NAME computers. The "Commuter" has every "State of the Art" feature you want at a Spectacular price. Runs ANY program with ease. This Ad was created on this machine. Light weight & Ultra portable **The PERFECT CHRISTMAS GIFT**

IBM Thinkpads
Pentium P-75 -or- 486 DX4-100

Huge 10.5" ***Active Matrix SVGA Color*** Display (the Best)
33k FAX MODEM - 2 PCMCIA Expansion Slots
Dual Infrared Ports (Front & Rear)
Track Point Mouse All Standard Ports (1S,1P,1VGA,1Kbd)
Pop out - Hard Drive, Ram, Battery & Floppy.
Ram & Hard Drive Expandable & Upgradable.
Includes Power Supply & Hydride Battery
Free Lifetime Tech Support Web Site Creator Software
Internet Ready, America On Line 4.X Latest Version
Fax Modem Software, Searchable Owners Manual s/w, W95
DX4-100 810Meg Hard Drive Standard ***-or-*** (***2Gig*** only $59!)
16M Ram Standard -or- (optional 24M Ram $24 !)
Pentium P-75 **2Gig Hard Drive & 24 Meg Ram Standard**

DX4-100 — 3 easy payments of $218! — DX4-100 Dock $119 with purchase
Wow 0% Financing on Credit Cards only — Docks $189 alone
Pent-75 — 3 easy payments of $286! — Pent-75 Dock $39 with purchase

Over a Quarter Million Devices
2 Easy Payments $49!

FREE *Upgrade* which will Include a Huge, Asian Transistor Spec Database: $69option in the new version

"REFEREE"
CROSS REFERENCE & SPEC
Transistors, ICs & Diodes

A Specialist in "Hard to Cross House Numbers"
Easy, Powerful & Fast.
The Most Comprehensive Software Sold.

Yields Device Specifications & 75 to 250 Potential Replacements !

Replacement Numbers are Totally Global including Domestic, Asian, European, House, Branded, as well as ECG, NTE, SK & GE. Displays Case Drawings, Lead Configuration & Pin-outs for many Devices. Coverage of Replacement Numbers is Very Impressive. 7 Disk Set (17 Meg decompressed) For DOS, W3.1 & 95, 98 & NT. Current Version 7.11

Includes:
4 HUGE Consumer Electronics Industry Directories
1- Consumer Electronics Parts Sources (Service) 2- Consumer Electronics Manufacturers 3- The Entire Computer Industry 4- Semiconductor Manufacturers

#1 Choice of Service Centers

ICM *Bible of the IC Industry*
Every Cross-reference
3 Volume Set with Tons of Information

ICMaster Earlier Editions Perfect for Service or Lite Design Later Editions Perfect for Advanced Design

ICM $195 Publisher

95 3Book Set $29 !!!!!!!!!			
96 3Book Set $49 !!!!!!			
97 3Book Set $69 !!	CD Rom	$ 99!!	
98 3Book gone	CD "	$129!	
99 3Book gone	CD "	$179!	

EEM Contains the Complete Catalogs of Most Electronic ~~$119~~ Component Manufacturers & Distributors

EEM
97 4 Book Set only on CD $35
98 4 Book Set only on CD $55
2000 4 Book Set $79

IBM Docking Stations
From IBM ~~$450~~

This is not just a port expander it's a full blown docking station
You can add ANY desktop ISA card and it will work with your IBM laptop
Imagine the posibilities. Add a TV card and watch TV while you compute !
ISA computer card hides in the base of the unit.

FREE Local Area Network (LAN) card (a $79 value) Notebook Snaps onto the dock.
Expansion Port for optional CD Rom Built-in Speakers Built-in Power Supply & Fan
SCSI Expansion Port / Parallel / Serial / Keyboard / Mouse / Monitor / Stereo in & out
Front panel headphone Jack Hidden Carry handle LED Status Indicators
Color Black (matches notebook) ISA Port cover & Key optional (not required)

1 Year Warranty - Satisfaction Guaranteed - The Friendliest People - The Best Customer Service Email for Detailed Information
PAYMENT PLAN with Credit Card -or- Layaway ONLY 843-650-5700 For Questions-or- email: netcomd@aol.com
COD's SINGLE PAYMENT ONLY ORDERS ONLY 800-733-3733 ORDERS ONLY FAX 843 650 5777 10 - 8 EST Mon - Fri

ELECTRONICS Q & A

With TJ Byers

In this column, I answer questions about all aspects of electronics, including computer hardware, software, circuits, electronic theory, troubleshooting, and anything else of interest to the hobbyist.

Feel free to participate with your questions, as well as comments and suggestions.

You can reach me at:

TJBYERS@aol.com

TJBYERS@juno.com

or by snail mail at Nuts & Volts Magazine, 430 Princeland Ct., Corona, CA 92879.

What's Up:

Two Christmas wishes fulfilled and remote control/paging basics. Another round of PC hardware pinouts and adapters. An excellent look at AT keyboard codes, plus a couple of books for novice 68HC11 users.

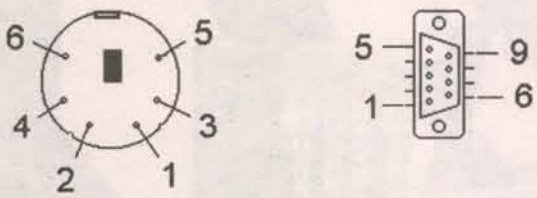
PS/2 to Nine-Pin Adapter

Q. I have several computers. Some have a PS/2 mini-DIN mouse port, while others have the standard nine-pin serial port, and I'd like to swap between one machine and another at will. For example, I have a Memorex Trackball with a nine-pin connector that I'd like to use on my PC with the PS/2 connector. Eventually I'd like to hook-up all my PCs with the various keyboard and mice combinations to one of those monitor/keyboard/mouse switchboxes. But, before I do, I need to resolve this first step of having multiple keyboards and mouses. So, can you give me a schematic to convert back and forth between the two connector types? Also, is there any actual difference between a PS/2 and nine-pin serial port other than just a connector issue?

Gary DePietro
Deltona, FL

A. This is exactly why the USB (Universal Serial Bus) was concocted. Its intent is to resolve compatibility problems just like you're experiencing — well, when it's finally completed. Meanwhile, your only choice is finding a suitable adapter between the PS/2 and serial mouse. Here's the pinout of that adapter cable, which is available from several sources, including **Digi-Key (800-344-4539; http://www.digikey.com)**, for about $3.00.

	PS/2 Mouse Connector	9-pin Serial Mouse Connector
GND	3	5
RxD	2	2
TxD	6	3
+5V	4	7



As for swapping between the PS/2 mouse and PC serial port, there's no guarantee it's a two-way street. Without going into detail, the data exchange protocol of the PS/2 and serial port isn't exactly the same, and I doubt your Memorex serial Trackball will work with your PS/2 port — but try it, who knows?

Remote Control Basics

Q. My Chaparral CR10 satellite receiver has a UHF remote. By searching the FCC database, I've learned that it operates at 418 MHz. Is there a way I can determine the modulation method, and possibly the code set used to control the receiver?

Ray Dabkowski
via Internet

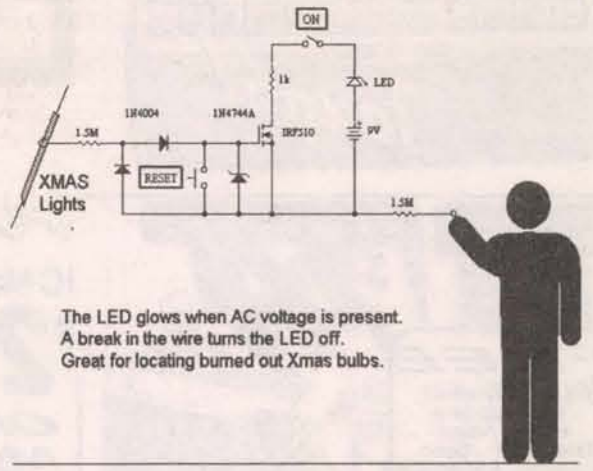
A. Like most remote controls, the Chaparral receiver uses pulse code modulation. In normal operation, pressing any key on the remote control generates a 38 kHz pulse code signal which modulates the 418 MHz UHF signal. This is the same carrier frequency and modulation method used by most standard TV infrared remote controls — but instead of using infrared light to communicate with the receiver, a 418 MHz is used as the transmission medium. (BTW, your Chaparral remote has an IR remote built into it, too.) At the UHF antenna module, the UHF signal is converted to a 38 kHz pulse code data signal which is sent to the VHF jack on the back of the satellite receiver. As to the code pattern, it can be measured at the UHF antenna module using a computer or digital storage oscilloscope.

Bad Bulb Detective

Q. A friend of mine tried building the "Bad-Bulb Locator for the Holidays" in the Dec. '98 issue, but he seems to be having some problems with it. It appears that the circuit functions, but is grossly insensitive. If he puts an input signal into the wand, and bypasses the 1.5M resistor, it makes the needle deflect. However, he had to use the output from a squarewave generator with about 7 volts, peak to peak, to make it work. Will this circuit detect a break in a DC circuit, or does it work only with AC? I suppose if you had some kind of frequency generator you could use that to put some AC on a normally DC circuit, and then use the unit to locate the break. BTW, it would have been nice if you had labeled the transistor leads in the schematic.

Gene Zastera
via Internet

A. Yes, that circuit proved to be less sensitive than I anticipated. It works great with large outside bulbs, but lacks detail when trying to find a break in tiny "star-like" light strings. Now that I've had a year to work on the problem, here's an updated version of the Bad Bulb Locator.



The LED glows when AC voltage is present.
A break in the wire turns the LED off.
Great for locating burned out Xmas bulbs.

This time, I've used a single enhanced FET (field-effect transistor) instead of two depletion FETs as before. This alone makes the circuit more sensitive. The meter has been replaced with an LED and I'm using the human body as a conductor. When the hook-tip wand, which can be anything from a piece of solid copy wire to a paper clip, is slipped over the insulated AC wire, the voltage is rectified by the two 1N4004 input diodes and placed on the gate of the FET. The 1N4744A clamps this input at 15 volts to prevent damage to the FET. The source lead of the FET is connected to the negative end of a 9-volt battery, and the drain to the positive end via the 1k resistor, ON/OFF switch, and LED. Your body provides the ground connection (don't worry, the current isn't enough to even give you a tingle).

To use the wand, hold it in your hand and slip the loop over the AC wire. If AC voltage is present, it will generate an electric field which causes the FET to conduct and turn on the LED. If there is no AC voltage in the wire, the LED won't light. Start at one end of the chain and go from bulb to bulb until the LED doesn't light. If the LED lights on one side of the bulb but not the other, it's burned out. Because of the high input resistance of the FET, a reset switch is needed to turn

CABLE TV CONVERTERS

	5 lot	10 lot	20 lot	50+	100+
▸▸Viewstar MXC - 2020 85 CH Plain Converter PG Lock HRC/STD SleepTimer	$45.	$40.	$35.	$30.	Call
▸▸Century CTC - 3000 99 CH Plain Converter PG Lock HRC/STD SleepTimer	$50.	$45.	$40.	$35.	Call
▸▸Panasonic TZPC 175 99 CH- /Volume	$67.	$65.	$62.	$60.	Call
▸▸View Master VM 125 V 125 CH /Volume	$77.	$70.	$67.	$65	Call

All converters are factory new with remote control. Call us today for all your cable accessory needs.

DIRECT FACTORY SUPPLY, INC.
1-888-748-0946

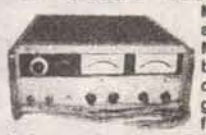
E-MAIL YOUR REQUESTS TO: DIRFACSUP@AOL.COM (No Descrambler Sales)

ELECTRONIC MILITARY SURPLUS

FAIR RADIO SALES

WEBSITE: fairradio.com
E-MAIL: fairadio@wcoil.com
PHONE: 419-227-6573
FAX: 419-227-1313
1016 E. Eureka - Box 1105
Lima, OH 45802
VISA, MASTERCARD, DISCOVER
Address Dept. N/V

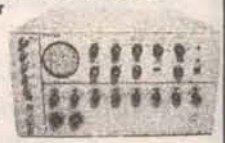
HP-8405A Vector Voltmeter



Measures both magnitude and phase over 1 to 1000 MHz in 21 overlapping bands. Also capable of determining insertion loss, group delay of bandpass filters, complex impedance of mixers and antennas, RF distortion and in-circuit probing. Band-width: 1 KHz. Includes manual, power cord, and accessory kit: 10:1 Divider Tips (2), Isolator Tips (2), BNC/Probe Adapters (2), Probe Tips (6), Probe Tip Wrench, Probe Holder Clips (2), Ground Clips (6). 7x16.6x18.4, 36 lbs, Unused, $450.00

SERVICE MONITOR

Singer Model CSM-1 Communications Service Monitor; Signal Generator 50 KHz - 512 MHz, Frequency Meter, and Amplitude Modulation meter; 0-30% & 0-100%. 17.1x16.2x9.2, 50 lbs sh., used reparable with op's manual, $250.00



Allow money for shipping on merchandise.

SEND FOR OUR
1999 FALL SUPPLEMENT

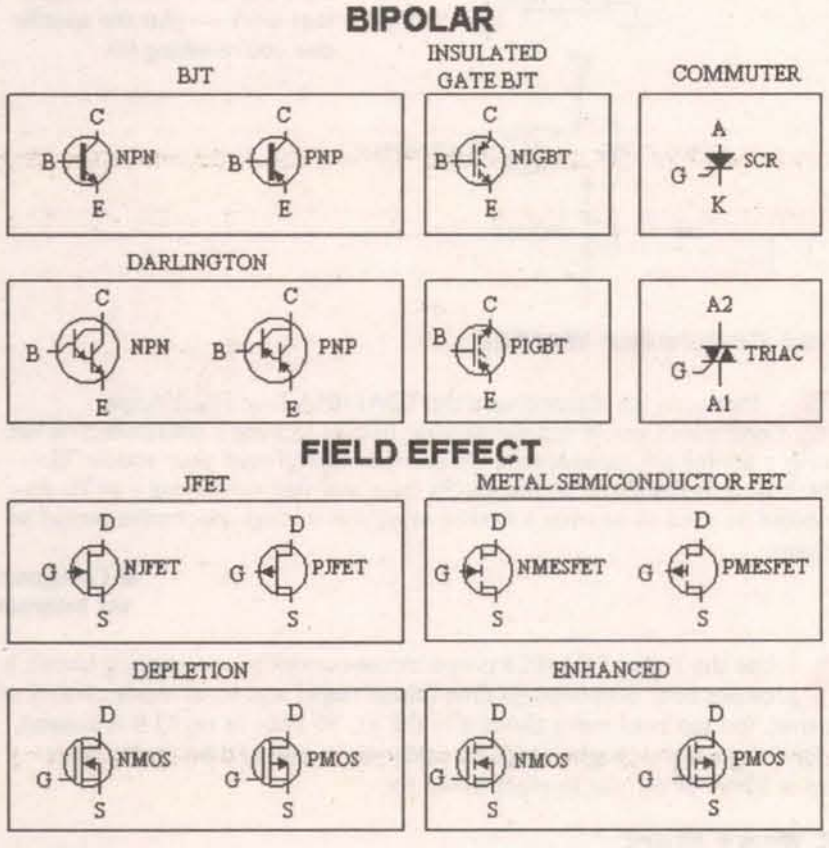
Radios - Test Equipment - Tubes - Antennas

Write in 53 on Reader Service Card.

Electronics Q & A

off the LED between bulbs.

BTW, adding identification labels to transistors clutter the drawing and they're hard to read, that's why I don't use them. Unlike ICs (which I always label), the transistor's symbol tells you all the pinout information you need. Here's a handy chart that you might want to copy and add to your electronics notebook or tape to your workshop wall for future projects. In fact, I receive enough requests like this that you can find this chart on our Web site (http://www.nutsvolts.com) under the name XISTOR.PCX, which you can download and then print out using Windows Paint.

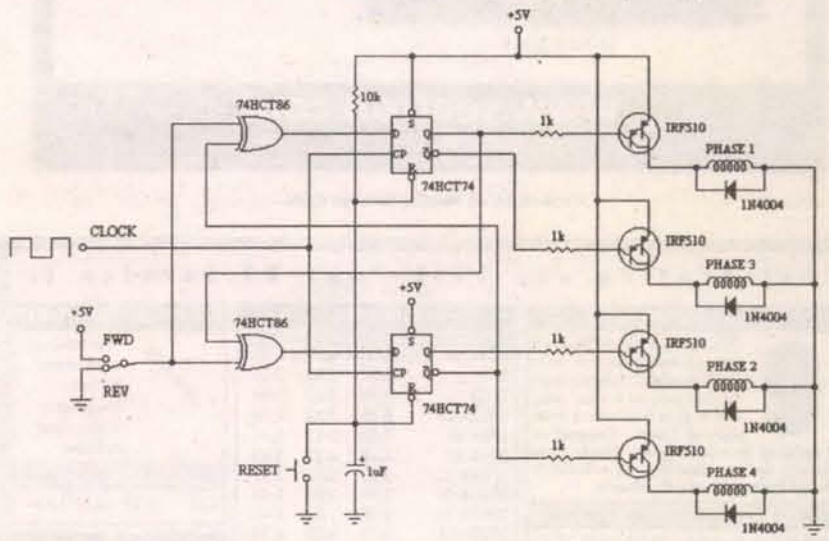


Make It A Merry Christmas!

Q: I work with a bunch of retirees who refurbish old computers that we then give to needy non-profit organizations. In the last five years, we have given away over 2,000 computers. My expertise is with printers, which are mainly of the dot-matrix variety. When a printer is beyond repair, I cannibalize them best I can — and as a result have acquired quite a collection of stepper motors. The problem is that the motors from Epson printers only have an "EM" designation on them. Do you possibly know where I could get the specs on these motors? Who knows, I might be able to come up with a unique toy for less fortunate kids. What I basically need is the voltage of the motors and possibly a controller circuit that doesn't require a computer interface.

Ken Zeman
Kpzeman@aol.com

A: The part number is EM210 ... and its kin. It's a 12-volt, six-wire unipolar stepper motor. Here's a simple driver circuit for this stepper motor that you can build for under $10.00 (even at RadioShack prices!).



As you can see, this driver is for a five-wire unipolar stepper motor, which you can easily create. Two of your four stepper coils already have one leg in common. Using an ohmmeter, find the other two coils with a common and tie the two commons together to make one common. The resistance of each of the four coils is equal and measures between 35 and 75 ohms. And that's it. Finally, decipher the wire colors for phases 1 through 4. The table below kinda depicts the industry standard, but I've seen steppers with nothing but brown leads, so ...

Table: Typical Unipolar Stepper Motor Color Code

Coil	Color
Phase 1	Red
Phase 2	Green
Phase 3	Brown
Phase 4	White
Common	Black

I applaud the work you and your friends do, and I urge our readers who are going to toss out an old computer because Santa delivered a new one to consider tossing it in the direction of Ken and his group. Contact him at the e-mail address above. He and everybody involved will thank you for your generosity!

Serial Port Voltages

Q: I'm looking to send a signal from my PC's serial port that will close a set of contacts or impulse a relay. I have Visual Basic 4.0 and feel capable of writing the software needed. What I don't know is which pins are which and what the voltage level would be. I need this interface to activate a security-door strike that requires 12 volts DC at 51 mA. Could you show me a circuit that would do this? I'm considering an optoisolater or transistor interface.

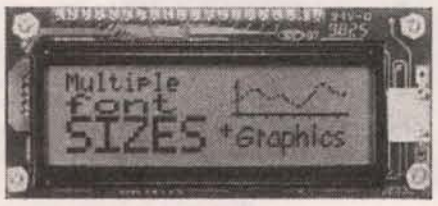
Larry Fostano
via Internet

Serial in, graphics out.

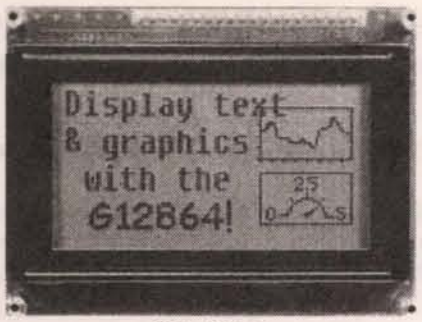
Almost *too* easy.

These serial displays take RS-232 at 2400 or 9600 baud and produce stunning text and graphics on a supertwist LCD screen. See our complete line at www.seetron.com. All models are in stock for immediate delivery.

G12032
120x32-pixel LCD
SGX-120L ***$99.00***
Same size as 2x16 text LCD
Editable font(s) in 4 sizes
Up to 6 screens in EEPROM
Easy terminal protocol



(3.2 x 1.4 in.)



(3.7 x 2.8 in.)

G12864
128x64-pixel LCD
$199.00 BGX-128L-I
Large, sharp LCD
Editable font(s)
Up to 14 screens in flash
Separate text, graphics layers
DB9 connector built in
AC adapter jack built in
Easy terminal protocol

www.seetron.com

Scott Edwards Electronics, Inc. ph 520-459-4802 fx 520-459-0623 nnv@seetron.com

Write in 54 on Reader Service Card.

Celebrating our 17th Year Of Service !!

COLLIMATING LENS

This economical collimating lens assembly consists of a black anodized aluminum barrel that acts as a heat sink, and a glass lens with a focal point of 7.5mm. Designed to fit standard 9mm laser diodes. Simply place diode in the lens assembly, adjust beam to desired focus, then set with adhesive.

STOCK#	1-9	10-24	25+
LSLENS Lens Assembly	24.99	23.74	21.37

DIODE/TRANSISTOR TESTER KIT

This dynamic tester allows checking of transistors & diodes in circuit. Identifies NPN or PNP transistors. Checks all types, small or large power. Identifies anode or cathode of diodes.

STOCK#	1-9	10-24	25+
DT100K	24.99	23.74	21.37

ANTI-STATIC FOAM CLEANER

A thick, foaming cleaner for use in static sensitive applications. Safe for plastics and fiberglass. Use on computer cases and all office equipment. Also cleans soft fabrics. 5 oz. aerosol can.

STOCK#	1-9	10-24	25+
SB1102	1.99	1.89	1.70

EPROMS

STOCK#	1-24	25-99	100+
2716	2.99	2.84	2.56
2732	4.49	4.27	3.84
2732A-20	5.49	5.22	4.70
2764-20	5.39	5.12	4.61
2764-25	4.49	4.27	3.84
2764A-20	3.49	3.32	2.99
2764A-25	2.99	2.84	2.56
27C64-15	2.99	2.84	2.56
27256-15	4.79	4.55	4.10
27C256-15	2.99	2.84	2.56
27512-25	3.09	2.94	2.65
27C512-25	2.99	2.84	2.56
27C010-15	2.79	2.65	2.39
27C020-15	3.49	3.32	2.99
27C040-12	5.49	5.22	4.70
27C080-12	10.99	10.44	9.40

Popular I.C.'s

STOCK#	1-24	25-99	100+
7400	.39	.37	.33
74LS00	.19	.18	.16
4017	.29	.28	.25
7805T	.33	.31	.28
7812T	.33	.31	.28
LM317T	.49	.47	.42
LM386N-1	.33	.31	.28
NE555N	.24	.23	.21
LM741N	.24	.23	.21
NE5532N	.55	.52	.47
68HC705C8P	8.99	8.54	7.69
8749	17.99	17.09	15.38
62256LP-10	2.79	2.65	2.39
2816	2.79	2.65	2.39

FM MICROPHONE KIT

Transmit your voice on any FM radio. Range up to 1000'. Case included

STOCK#	1-9	10-24	25+
K30	15.99	15.19	13.67

What Do We Have ?

- I.C.'s
- Oscillators
- Crystals
- Diodes
- Tools
- Laser Diodes
- Vises
- Resistors
- Capacitors
- Connectors
- Trimpots
- Kits
- Vises
- LED's
- Transistors
- And more!

GADGETEER'S GOLDMINE

This exciting collection of electronic projects features experiments ranging from magnetic levitation and lasers to high-tech surveillance and digital communications.

• By Gordon McComb

STOCK#	1-9	10-24	25+
TB3360	24.99	23.74	21.37

- Order Line — (800) 824-3432 • International — (724) 495-1230 • Fax Orders — (724) 495-7882
- Technical Support — (724) 495-1231 • No Minimum Order – (Orders under $20 subject to $ 5 charge) •UPS 3 day, Blue, Red, & Fed. Ex. Shipping Available (Call for charges) • PA Res. Add 7 % Sales Tax •Open Mon-Fri 9:00 AM - 5:00 PM (EST) • Corporate Accounts / Quantity Discounts Available •We accept M/C, VISA, Discover & American Express with no surcharge • Call For FREE Catalog ($2.00 Outside U.S.)
- We Carry A Complete Line Of Electronic Components • Email - unielect @ aol.com

Visit us on the web ! www.unicornelectronics.com

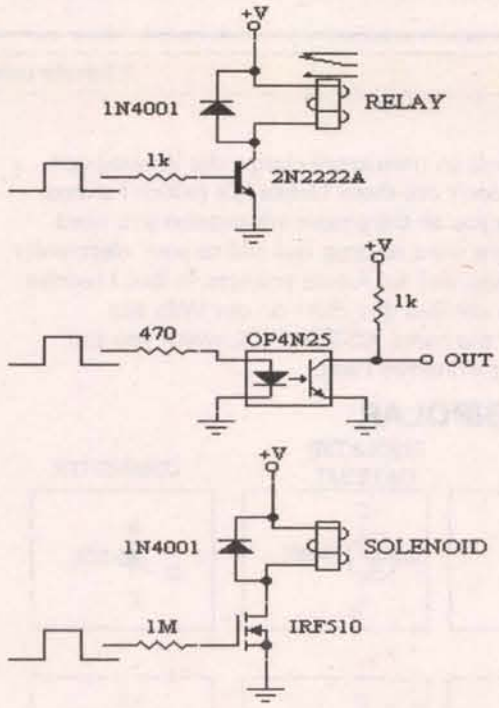
FREE SHIPPING!! on pre-paid orders

Unicorn Electronics
1142 State Route 18
Aliquippa, PA 15001

Write in 55 on Reader Service Card.

A - Excellent choice on the opto or transistor interface. That'll certainly protect the PC from damage through the port. Now, about the port. Inside the PC, the part you don't see, is an IC driver chip that's controlled by the CPU. On the other side of this chip is the RS-232 port — better known as the serial port. This port comes in two versions, one with a 25-pin connector and the other with a nine-pin connector. Here are the pinouts for both.

Function	Mnemonic	Input/Output	DB-25 pin	DB-9 pin
Protective GND	—	—	1	—
Transmitted Data	TD	Input	2	3
Received Data	RD	Output	3	2
Request To Send	RTS	Input	4	7
Clear To Send	CTS	Output	5	8
Data Set Ready	DSR	Output	6	6
Signal GND	GND	—	7	5
Received Line Signal	CD	Output	8	1
Data Terminal Ready	DTR	Input	20	4
Ring Indicator	RI	Output	22	9



All RS-232 outputs are TTL compliant. That means they are capable of driving at least one LS/TTL logic gate (typically 10 gates) at a 5-volt logic level. This is more than enough power to trigger semiconductor devices like an optoisolator or 2N2222 transistor. All RS-232 inputs are TTL/CMOS compliant, which is typically less than one TTL load. Here's a medley of interface designs that work — plus the specific one you're asking for.

Triac Controller Wanted

Q - Motorola has discontinued the TDA1185A Triac Phase Angle Controller. I would appreciate your help in locating a substitute, not necessarily a pin for pin replacement. On another topic, I read your article "EL Light: Playing In The Dark" in the Jul. '99 issue and was wondering if an EL driver could be used to provide a tickling sensation through electrodes placed on the skin.

Al Colaguori
via Internet

A - Use the Philips TDA1023 proportional-control triac triggering circuit. It provides both proportional time (phase angle) and burst mode control of the triac. You can read more about it in the Jul. '99 issue in my Q & A column. As for using a high-voltage source to tickle your senses, I'd be careful. All it takes is 20mA of current to electrocute you.

PC Won't Start

Q - My ATX computer doesn't turn on when I press the front power button. I believe the switch starts the motherboard components to trigger the power supply on. When I measured the voltage at one connector, I could only find a +4.98-volt source. I think there should be more voltages on this connector before the power supply can be started. Any information would be appreciated.

Jim
via Internet

A - You're correct in reckoning that there is handshaking between the power supply and motherboard before the system will power up. However, it all starts with the power supply, which the front panel switch is wired to. When the power switch is closed, a high-frequency inverter inside the power supply generates four output voltages: +5V, -5V, +12V, and -12V. All four must be present for the system to work; when all four are available and stabilized, the motherboard returns a "Good Power" indicator and the system pow-

ers up. Any break in this loop will prevent the power-up sequence from happening and shuts the power supply down.

So where do you start? The fact that you have +5 volts leads me to believe that the power supply is working. To verify that all the voltages are correct, locate the P8 and P9 power connectors from the power supply that plug into the motherboard. The voltages should measure according to the table below. If these voltages aren't present, replace the power supply.

PS Plug	Pin	Name	Color	Description
	1	PG	Orange	Power Good; +5V when all voltages are ready
	2	+5V	Red	+5 volts (optional)
P8	3	+12V	Yellow	+12 volts
	4	-12V	Blue	-12 volts
	5	GND	Black	Ground
	6	GND	Black	Ground

PS Plug	Pin	Name	Color	Description
	1	GND	Black	Ground
	2	GND	Black	Ground
P9	3	-5V	White	-5 volts
	4	+5V	Red	+5 volts
	5	+5V	Red	+5 volts
	6	+5V	Red	+5 volts

If the power supply is okay, then you need to look at the system itself. Have you changed the system lately — like install new software or added/subtracted a piece of hardware? My first suspicion would be a software program that's preventing the system from booting. This could be anything from a software patch to "fix" a bug that's now even buggier to a new screen saver that doesn't agree with your system. My second choice would be a Plug-n-Play modem that ain't playing.

(Editor's note: Jim sent the follow-up message after reading my E-mail response. "Thank you for the information on the ATX power supply. It gave me the voltages I needed to determine that my power supply was indeed bad (the problem was intermittent and hard to locate). Thanks again for the help.")

Remote Pager On The Cheap

Q. I need help! I'm a novice when it comes to electronics, but I love the hobby and I'm learning more every day. What I need is a circuit that, to the best of my knowledge, should be simple to find and build. Despite searches via the Internet, magazines, and books, I've had no luck. Everything I've seen is way more complicated than I need for my project. What I'm trying to do is have two transceivers with a range of approximately 150 feet that can trigger which can be heard by both transceivers with an audio tone when a switch is pressed. This tone will continue until the sending transceiver is reset. Is this as simple as it sounds, or as complicated as others make it seem?

Kim Vertner
QA Engineer — ImageBuilder Software

A. It all depends on how you view the problem. First, you need to build a transceiver, which consists of a transmitter and receiver in one package — done twice. Next, you need an audio generator for the tone, another small but significant part of the project. So far, three modules plus a power source; things are adding up. Finally, a way to latch the signal until reset — another building block. When you look it in this prospective, it's a rather complex device. Know what I'd do? Go to Toys-R-Us or a department store and buy a pair of those cheap Morse code walkie-talkies. This is the kind that lets two kids send audio tones to each other using dots and dashes — it even has the code printed on the case. Many manufacturers make them, and they sell for less than $20.00. Moreover, each handset has all the building blocks outlined above and just before Christmas is an excellent time to find what you're looking for. Next open the case and locate the Morse code key button. Then go to Radio Shack and buy a cheap toggle switch that will fit inside or outside the cabinet and wire it in parallel with the Morse code button. When the external switch is closed, the audio generator will yell its head off in both transceiver speakers until that switch is turned off. That's a whole lot simpler and cheaper than building a walkie-talkie from scratch.

Op-Amp Substitute

Q. I'm repairing a Wavetek audio function generator and need two Motorola MC1712CP or Fairchild A702C op amps. I've tried the sources you list in your column, as well as a few that I've found on the Internet with no luck. The op amps run off a dual voltage of ±6 volts. Could you suggest an alternate op amp?

Cliff Mueller
via Internet

Discover PlanetTest.com...
Four new ways to buy, sell or trade— right from your computer!

Bid, Buy, Sell, Save at PlanetTest.com

Discover great prices everyday on new, reconditioned, and used products at PlanetTest.com. Browse through thousands of stand-alone test instruments, tools, accessories and manuals. Plus, you can sell your surplus equipment online.

Join our e-mail newsletter to stay informed of upcoming auctions from leading manufacturers.

The PlanetTest.com Network gives you four instant links to buyers, sellers and outstanding values around the globe.

1) Auction
The largest online test and measurement auction for buyers and sellers— where bids can start as low as $1!

2) Virtual Store
Shop for new, reconditioned, and used equipment direct from the manufacturer, distributor, re-seller, or end-user.

3) Classifieds
Search the Classifieds for a great deal on hard-to-find test instruments, manuals, microwave components, and MORE.

4) Tucker Electronics Store
Over 4,000 new and reconditioned instruments backed by extensive guarantees and warranties.

Here's just a few examples of what you'll find on PlanetTest.com

Direct From B+K Precision
2407A Mini Pro Multimeter
Bids Start @ (Retail Price $55) $23
3½-Digit LCD, Max. Reading 3200. AC/DC to 600V and to 10A. Resistance to 30MΩ, diode check, Data Hold and Continuity Test.
MORE INFORMATION ONLINE AT www.PlanetTest.com

Tektronix TDS210 60 MHz, 2-Channel Oscilloscope Bids Start @ $600
Factory Reconditioned with 3 year Warranty.
MORE INFORMATION ONLINE AT www.PlanetTest.com

Manuals
Prices Start @ $20
Hundreds of Manufacturers and Models to choose from. Over 20,000 online!
MORE INFORMATION ONLINE AT www.PlanetTest.com

Planet Test™ by TUCKER ELECTRONICS

800-527-4642 • www.PlanetTest.com
1717 Reserve Street, Garland, TX 75042 • P. O. Box 551419 • Dallas, Texas 75355-1419

Write in 56 on Reader Service Card.

A. If memory serves me correctly, the UA702C was the forerunner of Fairchild's (now a part of National Semiconductor) popular 709 and today's LM741 high-performance op amp. It was housed in an eight-pin TO-99 metal case. However, I can't remember (or find) the pinouts for this device, so I asked the Guru, Robert A. Pease. Bob works for National Semiconductor and has roots in engineering that go all the way back to the early '60s. I figured that if anybody could dredge up the pinout, he could. He did, and here it is.

Function	Pins A702C	Pins LM741H/LM741CH
GROUND	1	—
Inverting input (- input)	2	2
Non-inverting input (+ input)	3	3
-6 volts	4	4
Lag	5	—
Lead	6	—
Vout	7	6
+6 volts	8	7

I suspect an LM741 would work in your Wavetek generator, but you'll need to make certain changes. For instance, make sure you get the LM741H or LM741CH version which uses the same TO-99 metal can. You can buy both from QuestLink (http://www.questlink.com) for about $2.00 each. This amp will almost drop into your existing socket with just two exceptions. Leads 6 and 7 of the LM741 plug into holes 7 and 8 of the UA702 socket, and holes 5 and 6

DesignNotes.com

The First Place to Visit Before Tackling Your Design Projects

Free Circuits
Designing for $$'s
Online Tutorials
Design S/W
Eqpmt Specials
Design Help
Online Forum
Free Literature
Cool Links

Holiday Specials!

5Mhz Hand-Held Scope only $179

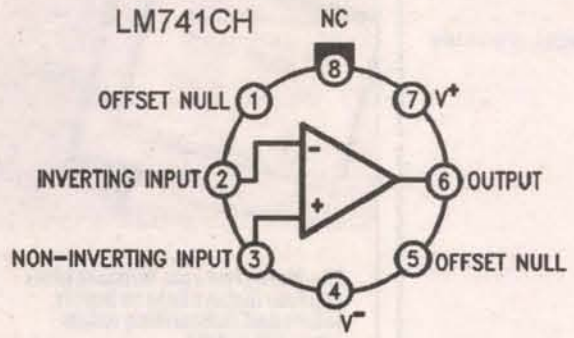
CAD Tools from $149

Share What You Know and Learn What You Don't

Visit Us at www.designnotes.com

Write In 57 on Reader Service Card.

of the UA702 socket are left open. That's because the LM741 is internally compensated, whereas the UA702 had external compensation between the Lag and Lead pins. You also don't need to plug anything into the number 1 pin hole because the LM741 case isn't grounded. Here's what the bottom of the LM741CH op amp looks like.



Keyboard Codes

Q. I've looked far and wide, yet I still can't find the codes used between the PC and keyboard to set-up and turn on the Caps Lock, Num Lock, and Scroll Lock LEDs. I need this information for a project I'm building.

Julian Restituyo
via Internet

A. Well look no further than http://www.geocities.com/SiliconValley/Bay/8302/keybrd.htm. Meanwhile, the following commands are sent by the PC to the keyboard to set/reset the status LEDs:

EDSet — This command alerts the keyboard that a command will be forthcoming to set/reset the status of the following LEDs:

- Num Lock
- Caps Lock
- Scroll Lock

After sending EDSet, the keyboard will reply with ACK (FA) and wait for the byte that will set the status of the keyboard LEDs:

- Bit 0 controls Scroll Lock
- Bit 1 controls Num Lock
- Bit 2 controls Caps Lock
- Bits 3 to 7 are ignored

FFReset — This command resets the keyboard.

MC68HC11 Tutorial Material

Q. About a year or so ago you mentioned a book that you wrote titled *Microprocessor Design Made Easy* published by AMS. I need a beginner's guide to the MC68HC11 series and would like to purchase this book, but the number you published doesn't work. Any suggestions?

Tom Miller
via Internet

A. Unfortunately, AMS is out of business and the book is no longer available. Fortunately, there are several 68HC11 tutorials available that should fill your needs. Here are two that I recommend.

MC68HC11 an Introduction: Software and Hardware Interfacing
Han-Way Huang, Ph.D. Iowa State University
Paperback/Published 1998
Price: $54.95
Book Description: This text has been designed to be a comprehensive first-semester book for an introductory course in microprocessors. The book is centered around the popular MC68HC11, with many examples, and is as close as I can find to my own.

68HC11 Microcontroller
Joseph D. Greenfield
Hardcover/Published 1992
Price: $87.50
Book Description: Teaches how to write programs for the microprocessor, particularly the powerful 68HC11, and has a reference section on the specifics of the MC68HC11. Intended as a text for a one-semester introductory microprocessor course.

Of course, you can download 68HC11 data sheets and application notes from **QuestLink (http://www.questlink.com)** at no charge, but it may take a while to digest the material in this very technical format.

Seasons Greetings!

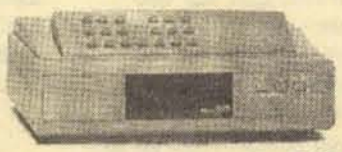
TJ Byers Q & A Editor

Converters ★ Remotes ★ Converters ★ Remotes ★ Converters ★ Remotes

Modern Communications • (405) 616-0100 TEL & FAX

Converters

Converters:	10	50	100
Panasonic: TZPC-175	$49.00	$45.00	$39.00
Panasonic: TZPC-145	$45.00	$39.00	$35.00
Centurion CF-3000 (NEW) True 99 Channel	$65.00	$60.00	$55.00
Regal: CR-83	$39.00	$35.00	$32.00
Remotes:			
Jerrold: 400, 450, 550	$4.50	$4.00	$3.75
CFT: 2XXX	$4.95	$4.50	$4.25
S/A: 175, 475	$4.95	$4.50	$4.25
S/A: 8600 Display	$4.95	$4.50	$4.25
Panasonic: 170, 175	$4.95	$4.50	$4.25
Zenith (ALL)	$4.95	$4.50	$4.25
Pioneer (ALL)	$4.95	$4.50	$4.25
Tocom 5503-VIP	$4.95	$4.50	$4.25
4-in-1 Universal	$5.95	$5.50	$5.25



Parts, Parts, Parts

	10+	50+	100+
PIC16C622	$3.15	$2.95	$2.75
PIC16C54RC/P	$2.15	$1.95	$1.75
PIC16C56RC/P	$2.15	$1.95	$1.75
Micro 68H705C8P	$6.50	$6.15	$5.95
4 MHz (Resonator 2 pins)	$0.45	$0.40	$0.35
4 MHz (3 pins)	$0.45	$0.40	$0.35
Crystal: 117, 119	$3.75	$3.50	$3.25
18 pin IC Socket	$0.15	$0.12	$0.10
Toggle Switch on/on	$0.95	$0.85	$0.75

Call for Larger Quantity Quotes

Remotes

Converters ★ Remotes ★ Converters ★ Remotes ★ Converters ★ Remotes

Write In 58 on Reader Service Card.

Download our latest catalog at http://www.alltronics.com

HANDY LITTLE TRAVEL CHARGER!

Input 120VAC, 60Hz, 0.10A. Output 13.8VDC @ 0.16A. Four-pin female connector, 0.1" spacing. Open circuit volts: 25VAC. Short curcuit current: 0.16A (for 1.6AH and larger NiCd battery. Size approx. 2.25"L x 1.88"W x 1.88"D

99E009 $6.95 each

AC/DC CONVERTER

Input 100-250VAC, 50-60Hz, 1.0-0.5A. Output: +12VDC @ 3.5A. Approx. 5.75"L x 3.3375"W x 2"D. Cord has molex connector.

99E008 $9.95 each

DESKTOP AC TRANSFORMER

Input" 120V, 60Hz, 20W. Output 18VCT @ 750mA. For use with audio radio or video equipment.

99E010 $4.95 each

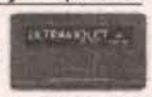
GREAT GIFT!

LED Flashlight

This flashlight is the newest in portable lighting technology. Three "AA" batteries will give 60 hours of light when you use the PL-W1 with one LED. There's no bulb to replace. This is a great light for cavers, backpackers, boaters and anyone who doesn't want to carry a lot of batteries and wants a dependable light. Put one into your Y2K "survival kit."

PL-W1 (1 LED) $14.95
PL-W2 (2 LEDs) $19.95
PL-W3 (3 LEDs) $24.95

LONGWAVE UV LAMP



This pocket-sized longwave ultraviolet light may be used for detecting invisible inks, minerals in rocks, etc. It's the size of a pocket pager and even has a belt clip to keep it handy. Runs on two "AA" batteries (not included). 3.25"W x 1.75"H x 1"D.

95L007 $7.95 each

INVISIBLE INK PEN!

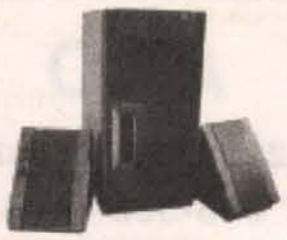
Use our ultraviolet lamp (95L007) to easily see the mark you've made on your valuables. This pen makes a broader, easier-to-see, mark than other UV pens.

96L005 $4.99 each

SPY STUFF!

This pen writes in "invisible ink" that becomes visible with our UV light (95L007).

96U002 $2.99 each



ADVENT AV370 AMPLIFIED MULTIMEDIA SPEAKERS with SUBWOOFER

Built-in amplifier gives the left and right speakers 20 Watts of audio power while the companion subwoofer puts out 30 Watts. Speakers measure 7" x 5" x 6" and subwoofer is 7" x 14" x 13". These are Advent speakers so quality is no doubt superb. List price was $234.95. Refurbished.

99V011 $69.95/set

LAVALIER STYLE ELECTRET MIKE

Omnidirectonal. 1500 Ohms impedance, 12-foot cord, 3.5mm phone plug.

99V014 $4.95

MULTIMEDIA BOOM MIKE WITH HEADSET

Includes RCA plugs and adapters for 3.5mm mono.

97A001 $5.95

13.8 VDC, 22A BENCH POWER SUPPLY

Input voltage 105-125 VAC 60 Hz. Output voltage 13.8 VDC. Output current 20 Amps continuous, 22 Amps surge. Brand new!

95E018 $99.95 each

UNIPOLAR STEPPER MOTOR DRIVER IC

UCN5804. Drives a unipolar stepper in one of three operating modes: single phase, two phase or half step. Up to 1.25 Amps per phase. Step and direction input. Drive with a 555 timer, parallel port, etc. Build your own robot, anything that requires precision positioning.

93I002 $4.50 each

PULSE MOTOR

42mm dia., 22mm thick. Shaft: 3mm dia. x 12mm long, with 13-tooth gear approx 16.6mm dia x 5mm thick. 7.5°/step, 48s/rev., 12VDC, 50 Ohms, 6-wire. With spec sheet.

92M010 $3.95 each

COMBO PACK!

One 93I002 IC and 92M010 motor (both shown above), with schematics.

93I003 $7.95/set

INFRARED KIT

Includes part #97V012 (assembled transmitter unit with forty-seven buttons)and receiver kit. Receiver kit includes PC board, IR detector, amplifier IC, and all components. Finished unit detects signal from transmitter and converts it to a serial TTL compatible signal.

93V010 $19.95 each

FUNCTIONALLY-CHALLENGED SIGNAMAIL UNITS

These units don't work! What you get are three sets each consisting of one 9V, 49.xxx MHz crystal-controlled FM transmitter, and a matching dual conversion narrwor-band FM crystal-controlled receiver/tone decoder/signal unit that runs on 6VDC. With documentation.

98Z011 Three for $10.00

PLUG & PLAY IDE CD-ROM INTERFACE CARD

System requirements: IBM PC 386SX and higher or 100% compatibles; plug and play operating system (Windows 95), or a Configuration Manager driver (INTEL CM for WIN 31/DOS). or 100% PnP BIOS; 16-bit ISA bus slot. Supports up to two CD-ROM drives. Supports all ATAPI compliant IDE CD-ROM drives. No DMA support. 16-bit I/O polled CD-ROM interface external connector. Hardware settings: IDE Interface Interrupt (IRQ): 10, 11, 12, 14, 15; IDE Interface Port: Secondary, Tertiary, Quaternary (Note: all settings are PnP setable. More may be available). External Connectors: 16-bit I/O polled CD-ROM interface.

98C007 20 for $19.95

SHAPE-MEMORY ALLOY LINEAR ACTUATOR

One inch-pound actuator made of Tinel.® Applications include robotics, doors, valves, toys, shutters, security devices, manipulators. Operated by temperature or electricity. De-energized length: 100mm. Energized length: 75mm. Self-activating temperature: 165°F. Spec sheets included.

95T001 $7.95 each

TV AUDIO DEMODULATOR

Originally used in cable TV application, this subassembly takes channel 3, 4 or 5 signal and demodulates the audio. Comes with documentation and schematics, plus additional schematics to build add-on video demodulator board.

92A028 $9.95 each

TOMINON HI-POWER LENS

1:4.5, f=230mm (9"), weight 4 lbs. Six coated symmetric glass lenses in black aluminum case, 3.625"" dia. by 4.375" long. Scale range from 1:10 to 1:1 to 10:1. Originally cost over $350.00. Unused.

92L034 $29.95 each

PRECISION EYEPIECE

21mm f:3.5. Four coated lenses in black aluminum case measuring 1.5625" long by 1.0" diameter, 35° angle of view without vignetting.

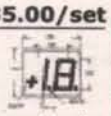
92L031 $4.95 each

SPECIAL PACKAGE

One Tominon High Power Lens (92L034) and one Precision Eyepiece (92L031) with documentation on how to build a wide field telescope.

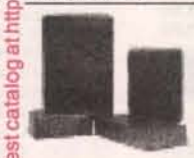
96L004 $35.00/set

ORANGE DISPLAY



Common anode. Peak wavelength: 630nm. Fwd Voltage: 2.0 typ. Luminous intensity: 2200 µcd. Size: 0.965" x 0.75", 18 pins.

MAN6630 $1.99



PLASTIC SPEEDY BOXES

ABS black plastic with slotted walls to accept PCBs. Screws included. Will not crack or split when drilled or punched.

PB114A - 1" x 3" x 2" **$2.20**
PB114B - 0.8" x 4.25" x 2.188" **$2.50**
PB114C - 1.563" x 3.875" x 2.938" **- $3.00**
PB114D - 2.313" x 5.875" x 3.938" **- $5.00**

ATARI 10-KEY NUMERIC KEYPAD

Three foot cord to DB9F connector, also works with Commodore. With schematics.

CX85 $4.95 each

ATARI 1020 COLOR PRINTER

For all Atari 8-bit computers. (Not PC-compatible!) Package includes: printer, power supply, software, pens, paper and interface cable. These are new units in factory sealed boxes.

94C037 $14.95 each

DIGITAL MULTI-METER

DC Voltage: 200m, 2, 20, 200, 1000V. Basic accuracy: ±0.5%. Input impedance: 10M. Maximum input: 1000V DC. AC Voltage: 200m, 2, 20, 200, 750V. Basic accuracy: ±0.8V. Input impedance: 10M. Frequency range: 40Hz-400Hz. Maximum input: 750V AC. DC current: 220m, 200m, 10A. Basic accuracy: ±1%. Resist: 200, 2K, 20K, 200k, 2M, 20M, 200M. Basic accuracy: ±1.5%. Frequency: 2KHz-220KHz. Basic accuracy ±1.5%. Capacitance: 2nF, 20nF, 200nF, 2µF, 20µF. Continuity buzzer, transistor test, diode test, low battery sign. Maximum display: 1999. LCD display size: 43mm x 68mm.

99Z007 $59.95 each

"T HUNT" TRANSMITTER

Good for "T Hunts," Beacon, CW, Rig, Telemetry experiments, etc. This one-Watt transmitter will operate from approx. 100 MHz to 150 MHz. 24 MHz crystal is included (may be tuned to harmonic). Assembled, with documentation. Must be modified to frequency of choice. Runs on 9VDC.

97K003 Only $24.95 each

200W MINI TOWER POWER SUPPLY

Like new. Standard mounting and hookup.

95C023 $14.95 each

GREAT GIFT!

The 2000 ARRL Handbook For Radio Amateurs

Since 1926, The Handbook has served hams and professional engineers as *the standard* for applied electronics and communications information. This 77th Edition includes 30 chapters (1,200 pages!) with more new technical reference and projects: a 1500W linear amplifier for 6 meters; a versatile two-radio, computer-controlled switchbox; sophisticated output filters for power amplifiers; an expanded section on HF mobile antennas; detailed coverage of the hottest new mode - PSK31; and a clever homebrew vacuum operated pick-and-place SMD component handler. Includes PC templates. *The ARRL Handbook* is written and edited by radio amateurs for anyone with an interest in communications. Softcover.

00X001 $32.00

ALLTRONICS

2300-D Zanker Road - San Jose, CA 95131-1114

World Wide Web: http://www.alltronics.com

(408) 943-9773 - Fax (408) 943-9776

Store Hours: 9-6 M-F & 10-3 Sat. - Pacific
Visa, M/C, AmEx Accepted. All Sales Final.
California Residents Add Sales Tax.
Shipping Additional on All Orders
Prices Subject to Change Without Notice.
Prices Good 60 Days from Date of Publication

Visit our website and download our catalog. 9912

Download our latest catalog at http://www.alltronics.com

WESTERN TEST SYSTEMS

WE BUY AND SELL

Inquiries **307-635-2269** • Fax **307-635-2291**

Orders **800-538-1493**

2701 Westland Court, Unit B, Cheyenne, Wyoming 82001

OSCILLOSCOPES & ACCESSORIES

OSCILLOSCOPES

TEK 2445 150 MHz 4-channel Oscilloscope $1,400.00
TEK 2465 300 MHz 4-channel Oscilloscope $2,250.00
TEK 7104 1 GHz 2-Channel Oscilloscope, ... $3,000.00
w/7A29,7A29-04,7B10,7B15
TEK 7844 400 MHz Dual Beam Oscilloscope $900.00
with 7A24,7A26,7B80,7B85
TEK 7904 500 MHz Oscilloscope, ... $900.00
with 7A24, 7A26, 7B80, 7B85
TEK SC503 10 MHz Dual Trace Storage $375.00
Oscilloscope, TM500 series

PROBES

HP 1122A Probe Power Supply $150.00
HP 54701A 2.5 GHz 10X FET Probe, ... $1,000.00
for 54700 series oscilloscopes
TEK 1101 Accessory Power Supply, for FET probes $200.00
TEK A6901 Ground Isolation Monitor $200.00
TEK A6902B Voltage Isolator, DC-20 MHz, 20 mV-500 V/div. $600.00
TEK P6046 100 MHz Differential Probe $500.00
TEK P6201 900 MHz 1X/10X/100X FET Probe $450.00
TEK P6202A 500 MHz 10X FET Probe $250.00
TEK P6204 1 GHz 10X FET Probe, for TDS series $450.00
TEK P6205 750 MHz 10X FET Probe, for TDS series $325.00
TEK P6701-opt.02 O/E Converter, ... $175.00
450-1050 nm/0-1 mW: DC-700 MHz, ST conn.

CALIBRATION

TEK 067-0587-02 Signal Standardizer Calibration Fixture $750.00
TEK SG503 Level Generator, 250 kHz-250 MHz, TM500 series $600.00

WAVEFORM GENERATORS

FUNCTION

HP 3312A 13 MHz Function Generator $500.00
HP 3325A 21 MHz Synthesized Function Generator, HPIB $1,000.00
HP 3325A-002 21 MHz Synthesized $1,500.00
Function Generator, HV output option
HP 8165A-002 Prog. Signal Source, 1 mHz-50 MHz, log sweep .. $1,250.00
HP 8904A-001,002,004 Multifunction Synthesizer, DC-600 kHz .. $2,500.00
TEK AWG5102 Arb.Waveform Gen., ... $900.00
20 MS/s,12 bits,50ppm synthesis <1MHz
TEK AWG5105-opt.02 Arbitrary Waveform $1,250.00
Generator, dual channel option
TEK DD501 Digital Delay & Burst Gen., for function & pulse gen's . $275.00
TEK FG501 1 MHz Function Generator, TM500 series $225.00
TEK FG502 11 MHz Function Generator, TM500 series $300.00
TEK FG503 3 MHz Function Generator, TM500 series $250.00
TEK RG501 Ramp Generator, TM500 series $175.00
WAVETEK 288 20 MHz Synthesized Function Generator, GPIB $750.00

PULSE

BERKELEY NUCLEONICS 7085B $750.00
Digital Delay Generator, 0-100 mS, 1 nS res.,5 Hz-5 MHz
HP 8007B 100 MHz Pulse Generator $600.00
HP 8012B 50 MHz Pulse Generator, variable transition time $600.00
HP 8080A/81A/83A/84A 300 MHz Word Generator $800.00
HP 8080A/91A/92A/93A 1 GHz Single Channel Pulse Generator ... $950.00
HP 8111A-001 20 MHz Pulse/Function $1,250.00
Generator; counted burst option
HP 8112A 50 MHz Programmable Pulse Generator, HPIB $4,000.00
HP 8115A 50 MHz Dual Channel Pulse Generator, HPIB $2,750.00
HP 8116A 50 MHz Pulse / Function Generator, HPIB $3,500.00
HP 8116A-001 50 MHz Pulse / Function $3,900.00
Generator, HPIB; burst option
TEK PG502 250 MHz Pulse Generator, Tr<1nS, TM500 series $600.00
TEK PG505 100 kHz Pulse Generator, 80 V peak, TM500 series ... $275.00
TEK PG508 50 MHz Pulse Generator, TM500 series $400.00
WAVETEK 802 50 MHz Pulse Generator $300.00

VOLTAGE & CURRENT

VOLTMETERS

FLUKE 845AR High Impedance Voltmeter / Null Detector $400.00
HP 3456A 6-1/2 Digit Voltmeter, HPIB $500.00
HP 3457A 7-1/2 digit Voltmeter, HPIB $1,200.00
HP 3478A 5-1/2 digit Multimeter, HPIB $600.00
KEITHLEY 181 6-1/2 digit Nanovoltmeter, ... $900.00
10 nV sensitivity, GPIB
SOLARTRON 7081 8-1/2 digit Voltmeter $3,250.00
TEK DM5010 4-1/2 digit Multimeter, TM5000 series plug-in $300.00
TEK DM501A 4-1/2 digit Multimeter, TM500 series plug-in $225.00

CALIBRATION

FLUKE 510A AC Reference Standard, 10 VRMS, 0-10 mA $450.00
FLUKE 515A Portable Calibrator, ... $900.00
DC/AC/Ohms, line & battery power
FLUKE 5220A Transconductance $3,000.00
Amplifier, DC-5 kHz, 0-20 A
VALHALLA 2703 AC Volt.Std., ... $1,500.00
0-120V/10 Hz-100 kHz;120-1200V/10 Hz-1 kHz

VOLTAGE SOURCES

HP 6114A Precision Dual Range $850.00
Power Supply, 20 V 2 A/ 40 V 1 A
HP 6115A Precision Dual Range Power $850.00
Supply, 50V 0.8A / 100V 0.4A
KEITHLEY 228 Programmable Voltage/Current Source $1,900.00

CURRENT METERS & SOURCES

HP 4140B Picoammeter / DC Voltage $2,000.00
Source, without test fixture
HP 6177C DC Current Source, to 50 V, 500 mA $500.00
HP 6181C DC Current Source, to 100 V, 250 mA $500.00
HP 6186C DC Current Source, to 300 V, 100 mA $750.00
KEITHLEY 225 Current Source, ... $500.00
0.1 uA-100 mA, 10-100 V compliance
KEITHLEY 227 Current Source, 1 uA-1 A, 0-50 V compliance $800.00
TEK CT-5 High Current Transformer $375.00
for P6021/A6302, to 1000A
TEK P6022 AC Current Probe w/termination, ... $275.00
935 Hz-120 MHz, 6 A pk

IMPEDANCE & COMPONENTS

L.C.R.

BOONTON 62AD 1 MHz Inductance Meter, 2-2000 uH $550.00
BOONTON 72BD 1 MHz Capacitance $650.00
Meter, 3-1/2 digit display
HP 4262A-101 3-1/2 digit LCR Meter, ... $1,500.00
120 Hz/ 1 kHz/ 10 kHz test, HPIB

STANDARDS

E.S.I. SR-1 Standard Resistor, various values $125.00
E.S.I. SR1010 Resistance Transfer $550.00
Standards, 1 Ohm-100 K/step
E.S.I. SR1050-1M Resistance Transfer Standard, 1 Megohm/step $2,000.00
GR 1404-A 1000 pF Reference Standard Capacitor $700.00
GR 1406 Standard Air Capacitors, ... $375.00
GR900 connector, 0.1% acc.
GR 1432-U 4-Decade Resistor, ... $100.00
0-111.10 Ohms, 0.01 Ohm resolution
GR 1433-J 4-Decade Resistor, 0 ..... $150.00
-11,110 Ohms, 1 Ohm resolution
GR 1433-K 4-Decade Resistor, ... $150.00
0-1,110 Ohms, 0.1 Ohm resolution
GR 1433-L 4-Decade Resistor, ... $150.00
0-111,100 Ohms, 10 Ohms resolution
GR 1433-N 5-Decade Resistor, ... $200.00
0-11,111 Ohms, 0.1 Ohm resolution
GR 1433-X 6-Decade Resistor, ... $250.00
to 111,111.0 Ohms, 0.1 Ohm res.

HI & LO RESISTANCE

HP 4328A Milliohmeter $1,200.00

T.D.R.

TEK 1503B-03,04 T.D.R., 0-50,000 ft., ... $3,000.00
chart recorder & battery power
TEK 1503-opt.04 Time Domain Reflectometer, ... $1,400.00
0-50,000 feet,chart recorder

POWER SUPPLIES

SINGLE OUTPUT

HP 6032A 0-60 V 0-50 A 1000 Watt $2,000.00
max. Autoranging Power Supply
HP 6200B Dual Range Supply, ... $200.00
0-20 V 0-1.5 A/ 0-40 V 0-750 mA CVCC
HP 6207B 0-160 V 0-200 mA CV/CC Power Supply $200.00
HP 6256B 0-10 V 0-20 A CV/CC Power Supply $250.00
HP 6263B 0-20 V 0-10 A CV/CC Power Supply $400.00
HP 6266B 0-40 V 0-5 A CV/CC Power Supply $400.00
HP 6267B 0-40 V 0-10 A CV/CC Power Supply $550.00
HP 6274B 0-60 V 0-15 A CV/CC Power Supply $650.00
HP 6281A 0-7.5 V 0-5 A CV/CC Power Supply $150.00
HP 6282A 0-10 V 0-10 A CV/CC Power Supply $200.00
HP 6289A 0-40 V 0-1.5 A CV/CC Power Supply $200.00
HP 6299A 0-100 V 0-750 mA CV/CC Power Supply $200.00
HP 6384A 4.0-5.5 V at 8 A CV/CL Power Supply $125.00
HP 6443B 0-120 V 0-2.5 A CV/CC Power Supply $450.00
HP 6574A 0-60 V 0-35 A CV/CC Power Supply $1,675.00
HP 6672A 0-20 V 0-100 A CV/CC $2,750.00
Power Supply,HPIB, 191-250VAC line
KEPCO ATE 36-30M 0-36 V 0-30 A CV/CC Power Supply $900.00
KEPCO ATE 36-8M 0-36 V 0-8 A CV/CC Power Supply $375.00
LAMBDA LK-352-FM 0-60 V 0-15 A CV/CC Power Supply $600.00
SORENSON DCR 150-3B 0-150 V 0-3 A CV/CC Power Supply $500.00
SORENSON DCR $550.00
600-0.75B 0-600 V 0-750 mA CV/CC Power Supply
SORENSON DCS 40-25 0-40 V 0-25 A CV/CC Power Supply $650.00
SORENSON SRL 20-12 0-20 V 0-12 A CV/CC Power Supply $400.00
SORENSON SRL 60-8 0-60 V 0-8 A CV/CC Power Supply $600.00
TEK PS501-1 Power Supply, ... $175.00
0-20 V, 2 mV res., 400 mA, TM500 series

MULTIPLE OUTPUT

HP 6205C Dual Power Supply, ... $300.00
0-40 V 300 mA & 0-20 V 600 mA, CV/CL
HP 6228B Dual 0-50 V 0-1 A CV/CC Power Supply $450.00
HP 6253A Dual 0-20 V 0-3 A CV/CC Power Supply $450.00
HP 6255A Dual 0-40 V 0-1.5 A CV/CC Power Supply $450.00
KEPCO MPS-620M Triple Output Supply, ... $250.00
dual 0-20V 1A tracking & 0-6V 5A
LAMBDA LPD-422-FM Dual $300.00
0-40 V 0-1 A CV/CC Power Supply
LAMBDA LPT-7202-FM Triple Output Power Supply $450.00
TEK PS5010 Programmable $650.00
Triple Power Supply, TM5000 series
TEK PS503A Dual Power Supply, TM500 series $200.00

MISCELLANEOUS

ACME PS2L-500 Programmable Load, ... $350.00
0-75 V / 0-75 A / 500 Watts max.
ELGAR 501C/400SD AC Power Source, ... $1,150.00
45 Hz-5 kHz, 500 VA, 0-135 VAC
HP 59501B HPIB Isolated DAC/Power Supply Programmer $175.00
KEPCO BOP 20-20M Bipolar Op Amp/Power Supply, to 20 V 20 A $675.00
KEPCO BOP 36-5M Bipolar Op Amp/Power Supply, to 36 V 5 A $400.00
KEPCO BOP 50-2M Bipolar Op Amp/Power Supply, to 50 V 2 A $400.00
TRANSISTOR DEVICES DAL-50-15-100 ..... $200.00
Programmable Load, 0-50 V, 0-15 A, 100 Watts max.

TIME & FREQUENCY

UNIVERSAL COUNTERS

HP 5314A-001 100 MHz/100 nS Universal $275.00
Counter; TCXO reference option
HP 5315A-001 100 MHz/100 nS Universal $450.00
Counter, TCXO reference option
HP 5315A-002,003 100 MHz/100 nS Univ. $650.00
Counter; batt. power & 1 GHz C-ch.
HP 5315A-003 100 MHz/100 nS Univ. $550.00
Counter, 1 GHz C-channel option
HP 5315B 100 MHz/ 100 nS Universal Counter $500.00
HP 5316A 100 MHz/100 nS Universal Counter, HPIB $600.00
HP 5316A-001,003 100 MHz/ 100 nS Univ. $750.00
Counter, HPIB, TCXO, 1 GHz C-ch.
HP 5316B 100 MHz/ 100 nS Universal Counter, HPIB $750.00
HP 5370A 100 MHz/ 20 pS 11 digit $750.00
Universal Time Interval Counter
HP 5370B 100 MHz/ 20 pS Universal Counter, 11 digits $1,200.00
PHILIPS PM6672/411 120 MHz/100 nS $450.00
Universal Counter, C-channel 70-1000 MHz
TEK DC5004 Programmable $250.00
100 MHz/100nS Counter/Timer, TM5000 series
TEK DC5009 Programmable $400.00
135 MHz Univ. Counter/Timer, TM5000 series
TEK DC5010 350 MHz / 3.125 nS $950.00
Universal Counter, TM5000 series
TEK DC503A 125 MHz/100 nS $275.00
Universal Counter, TM500 series
TEK DC509 135 MHz/ 10 nS $275.00
Universal Counter, TM500 series

FREQUENCY COUNTERS

EIP 545A 18 GHz Frequency Counter $750.00
FLUKE 7220A-010,131,351 1.3 GHz $500.00
Counter; battery power, OCXO, and res. mult.
HP 5342A 18 GHz Frequency Counter $1,250.00
HP 5343A-001 26.5 GHz Frequency Counter, OCXO reference .. $3,000.00
HP 5343A-001,011 26.5 GHz $3,500.00
Frequency Counter, OCXO reference, HPIB .....
HP 5345A/5355A/5356B 26.5 GHz CW/Pulse Frequency Counter $3,500.00
HP 5350B 20 GHz Frequency Counter, HPIB $2,900.00
HP 5351B-001 26.5 GHz Frequency $4,250.00
Counter, HPIB, OCXO reference
HP 5364A Microwave Mixer / $3,000.00
Detector, for modulation domain an.
HP 5385A-004 1 GHz Frequency $800.00
Counter, HPIB; OCXO ref. osc. option
HP 105B Quartz Oscillator, 0.1/ 1.0/ 5.0 MHz, battery power $1,500.00
HP 5065A-003 Rubidium Freq. $2,750.00
Standard; clock & battery power options
HP 5087A-opt.032 Distribution Amplifier, 12 outputs at 5 MHz $1,750.00

AUDIO & BASEBAND

SPECTRUM ANALYSIS

HP 3586C Selective Level Meter, ... $1,200.00
50 Hz-32.5 MHz, 50 & 75 ohms

DISTORTION ANALYZERS

HP 8903A Audio Analyzer, 20 Hz-100 kHz $1,500.00

RMS VOLTMETERS

FLUKE 8922A True RMS Voltmeter, 180 uV-700 V, 2 Hz-11 MHz $450.00

OSCILLATORS

HP 3336C-004,005 21 MHz Synthesizer/ $1,400.00
Level Gen., OCXO & hi accuracy att.
TEK SG502 Sine/Square Osc., ... $200.00
5 Hz-500 kHz, 70 dB step atten.,TM500

MISCELLANEOUS

HP 3575A-002 Phase-Gain Meter, 1 Hz-13 MHz, dual display $850.00
HP 461A Amplifier, 20 dB or 40 dB gain, 1 kHz-150 MHz $125.00
HP 465A Amplifier, 20/40 dB, 5 Hz-1 MHz, 1/2 Watt/50 Ohms $125.00
HP 467A Power Amplifier, ... $375.00
X1/X2/X5/X10, DC-1 MHz, 10 W output
KROHN-HITE 3103 High/Low $350.00
Pass Filter, 10 Hz-3 MHz, 24 dB/octave
KROHN-HITE 3200 High Pass / $275.00
Low Pass Filter, 20 Hz-2 MHz, 24 dB/octave
KROHN-HITE 3202 Dual HP/LP/BP/BR $450.00
Filter, 20 Hz-2 MHz, 24 dB/octave
KROHN-HITE 3342R Dual HP/LP Filter, ... $900.00
0.001 Hz-99.9 kHz, 48 dB/octave
ROCKLAND 852 Dual Highpass/ $900.00
Lowpass Filter, 0.1 Hz-111 kHz
TEK AM502 Differential Amplifier, ... $475.00
0.1 Hz-1 MHz, TM500 series
WAVETEK 716 Brickwall Filter $1,500.00

Write in 155 on Reader Service Card.

VISA

90 DAY WARRANTY PARTS AND LABOR • 10 DAY INSPECTION
TEST EQUIPMENT WANTED CALL OR FAX LIST • OPEN ACCOUNTS

MasterCard

RF & MICROWAVE

SPECTRUM ANALYZERS

HP 11517A/18A/19A/20A Mixer Set, 12.4-40.0 GHz, for HP 8555A/8569A $500.00
HP 11970A WR28 Harmonic Mixer, 26.5-40 GHz $1,100.00
HP 11970K WR42 Harmonic Mixer, 18.0-26.5 GHz $1,100.00
HP 11970Q WR22 Harmonic Mixer, 33-50 GHz $1,400.00
HP 11970U WR19 Harmonic Mixer, 40-60 GHz $1,400.00
HP 70620B Preamplifier, 1.0-26.5 GHz, for 70000 series $3,900.00
HP 8559A/853A-001 Spectrum An., 0.01-21 GHz, 1 kHz res.,w/rackmount frame $3,750.00
HP 85640A Tracking Generator, 300 kHz-2.9 GHz, for HP 8560 series $5,000.00
HP 8568B Spectrum Analyzer, 100 Hz-1.5 GHz, 10 Hz min. res. $8,500.00
HP 8569B Spectrum Analyzer, 10 MHz-22 GHz, 100 Hz min.res.bw. $7,500.00
TEK WM782V WR15 Harmonic Mixer, 50-75 GHz $1,500.00

NETWORK ANALYZERS

HP 11650A Network Analyzer Accessory Kit, APC7 ..... $600.00
HP 35676A Reflection/Transmission Test Kit, 5 Hz-200 MHz $1,000.00
HP 85020A Directional Bridge, 10-4300 MHz, N(f) test port $650.00
HP 85027C Directional Bridge, 0.01-18 GHz, N(f) test port $1,750.00
HP 85027E Directional Bridge, 0.01-26.5 GHz, APC3.5(f) test port $1,900.00
HP 85046A S-Parameter Test Set, 300 kHz-3 GHz $3,000.00
HP 85054A Type N Calibration Kit, for HP 8510 series $1,800.00
HP 8757C-001 Scalar Network Analyzer; fourth detector input option $5,500.00
HP R85026A WR28 Detector, 26.5-40 GHz, for HP 8757 series $1,200.00
WILTRON 560-98KF50 SWR Autotester, 10 MHz-40 GHz, for Wiltron 560 series $1,800.00

SIGNAL GENERATORS

FLUKE 6060A Synthesized Signal Gen., 0.1-1050 MHz, 10 Hz res., GPIB $1,900.00
FLUKE 6060B/AK Synthesized Signal Gen., 0.1-1050 MHz, 10 Hz res $1,900.00
GIGATRONICS 1018 Synthesized Signal Gen., 50 MHz-18 GHz, 1 MHz res. $4,500.00
GIGATRONICS 600/6-12 Synthesized Source, 6-12 GHz, 1 kHz res., GPIB $2,500.00
GIGATRONICS 840-18 Freq. Multiplier, 18-26 & 26-40 GHz outputs 0 dBm $2,750.00
GIGATRONICS 875/50 Levelled Multiplier, x4, 50.0-75.0 GHz output, -3 dBm $2,500.00
GIGATRONICS 875/86 Levelled Multiplier, 26.5-40.0 & 50.0-75.0 GHz outputs $3,750.00
GIGATRONICS 900/2-8 Synthesized Signal/ Sweep Gen., 2-8 GHz, 1 MHz res.,GPIB $2,500.00
HP 11720A Pulse Modulator, 2-18 GHz, 80 dB on/off ratio $450.00
HP 85100V Frequency Mult., 10-15 GHz in / 50-75 GHz out >0 dBm $3,750.00
HP 8640B Signal Generator, 0.5-512 MHz, AM, FM, pulse modulation $950.00
HP 8657A-002 Signal Generator, 0.1-1040 MHz, 10 Hz res., HPIB $3,250.00
HP 8660C/86602B-002 Synth. Sig. Gen., 1-1300 MHz, FM / Phase mod. w/86635A $2,750.00
HP 8660C/86603A/86633B Synthesizer, 1-2600 MHz, 1 Hz res., AM / FM $3,250.00
HP 8672A Synthesized Signal Generator, 2-18 GHz, +3 dBm output $5,500.00
HP 8673E Synthesized Signal Generator, 2-18 GHz, +8 dBm output $9,500.00
HP 8673G-004,008 Synth. CW Signal Generator, 2-26 GHz, >+8 dBm output $12,500.00
HP 8684B Signal Generator, 5.4-12.5 GHz, AM/ WBFM/ Pulse $3,500.00

SWEEP GENERATORS

HP 8341B-003 Synthesized Sweeper, 10 MHz-20 GHz, low harmonics opt. $16,000.00
HP 8341B-004 Synthesized Sweeper, 10 MHz-20 GHz, +10 dBm;rear output $14,500.00
HP 8350A/83540A-002,004 Sweep Oscillator, 2.0-8.4 GHz, 70 dB step attenuator $4,000.00
HP 8350A/83545A-002 Sweep Oscillator, 5.9-12.4 GHz, 70 dB step attenuator $4,000.00
HP 8601A Generator/Sweeper, 0.1-110 MHz, +20 dBm levelled $400.00
HP 8620C Sweep Oscillator Frame $550.00
HP 86222B-002 RF Plug-in, 10-2400 MHz, +13 dBm levelled, 70 dB atten. $1,250.00
HP 86230B RF Plug-in, 1.8-4.2 GHz, +10 dBm unlevelled $375.00
HP 86241A-001 RF Plug-in, 3.2-6.5 GHz, +8 dBm levelled $300.00
HP 86245A-001 RF Plug-in, 5.9-12.4 GHz, +17 dBm levelled $600.00
HP 86250D RF Plug-in, 8.0-12.4 GHz, +10 dBm levelled $500.00
HP 86260A-H04 RF Plug-in, 10.0-15.0 GHz, +10 dBm unlevelled $500.00
HP 86290A-004 RF Plug-in, 2.0-18.0 GHz, +7 dBm levelled, rear output $1,750.00
WAVETEK 962 Sweep Generator, 1.0-4.0 GHz, markers, +12 dBm unlvld. $1,250.00
WILTRON 6647M Sweep Generator, 10 MHz-20 GHz, +10 dBm levelled $4,500.00

POWER METERS

ANRITSU MP-81B/ML-83A Power Meter, 75-110 GHz (WR10), -20 to +20 dBm $2,500.00
BOONTON 42B/41-4E Analog Power Meter, with 1 MHz-18 GHz sensor $450.00
HP 435B/8481A Power Meter, -30 to +20 dBm, 10 MHz-18 GHz $900.00
HP 435B/8481B Power Meter, 0 to +43 dBm, 10 MHz-18 GHz $1,500.00
HP 435B/8482H Power Meter, -10 to +34 dBm, 100 kHz-4.2 GHz $900.00
HP 436A-022/8481A Power Meter, -30 to +20 dBm, 10 MHz-18 GHz, HPIB $1,400.00
HP 436A-022/8484A Power Meter, -70 to -20 dBm, 10 MHz-18 GHz, HPIB $1,400.00
HP 8477A Power Meter Calibrator, for HP 432 series $500.00
HP K486A WR42 Thermistor Mount, 18.0-26.5 GHz, for 432 series $350.00
HP Q8486A Power Sensor, 33.0-50.0 GHz, WR22, for 435/6/7/8 ..... $1,500.00
HP R486A WR28 Thermistor Mount, 26.5-40 GHz, for 432 series $350.00
HP R8486A WR28 Power Sensor, 26.5-40 GHz, for HP 435/6/7/8 ..... $1,500.00

RF MILLIVOLTMETERS

RACAL 9303 TRMS Level Meter, 10 kHz-2 GHz, -77 to +23 dBm, GPIB $875.00

AMPLIFIERS, MISCELLANEOUS

ENI 1040L Amplifier, 55 dB gain, 10-500 kHz, 400 Watts $2,750.00
HP 415E SWR Meter $200.00
HP 8406A Comb Generator, 1/ 10/ 100 MHz increments, to 5 GHz $500.00
HP 8447A Amplifier, 20 dB, 0.1-400 MHz, 5 dB NF, +6 dBm output $375.00
HP 8447E Amplifier, 22 dB, 0.1-1300 MHz, +13 dBm output $750.00
HP 8447F-H64 Dual Amp., 25 dBG 0. 1-1300 MHz & 28 dBG 9 kHz-50 MHz $900.00
HP 8901A Modulation Analyzer, 150 kHz-1300 MHz $2,500.00
HP 8901B-1,2,3 Modulation An., 0.15-1300 MHz, rear input, OCXO, ext.LO $3,000.00
HP 8970A Noise Figure Meter $4,000.00
RF POWER LABS ML50 Amplifier, 2-30 MHz, 47 dB gain, 50 Watts, metered, 28V $350.00
ROHDE & SCHWARTZ ESH2 Test Receiver, 9 kHz-30 MHz $5,000.00

COAXIAL & WAVEGUIDE

AMERICAN NUCLEONICS AM-432 Cavity Backed Spiral Antenna,LHC, 2-18 GHz,TNC(f) *NEW* $95.00
AVANTEK AMT-400X2 WR28 Active Doubler, 13-20 GHz +10 dBm in, +10 dBm out $450.00
BAYTRON 3-28-300/10 WR28 Directional Coupler, 10 dB, 26.5-40 GHz $300.00
BIRD 6735-300 1 kW Load, 25-1000 MHz, LC(f), with wattmeter $650.00
BIRD 8201 500 Watt Oil Cooled Load, DC-2.5 GHz, N(f) $350.00
BIRD 8251 1 kW Oil-Dielectric Load, DC-2.4 GHz, N(f) $500.00
CONTINENTAL MW. RAE28-K-M WR28 x K(m) Endfire Adapter $225.00
FXR/MICROLAB S3-02N Triple Stub Tuner, 200-1000 MHz, 100 Watts max., N(m/f) $125.00
FXR/MICROLAB SL-03N Stub Tuner, 0.3-6.0 GHz, 100 Watts max., N(m/f) $75.00
GR 874-LTL Constant Impedance Trombone Line, 0-44 cm, DC-2 GHz $400.00
HP 11590A-001 Bias Network, 1.0-18.0 GHz, APC7 ..... $450.00
HP 11636A 2-Way Power Divider, DC-18 GHz, N(m/f/f) $300.00
HP 11692D Dual Directional Coupler, 22 dB, 2-18 GHz $800.00
HP 33321K Programmable Step Atten., 0-70 dB, DC-26.5 GHz, 3.5mm $475.00
HP 33327L-006 Programmable Step Attenuator, 0-70 dB, DC-40 GHz, 2.9mm $1,000.00
HP 774D Dual Directional Coupler, 20 dB, 215-450 MHz $275.00
HP 777D Dual Directional Coupler, 20 dB, 1.9-4.1 GHz $275.00
HP 778D-011 Dual Dir. Coupler, 20 dB, 100-2000 MHz, APC7 test port $450.00
HP 83017A Amplifier, 25 dB gain, 0.5-26.5 GHz, >+15 dBm $3,250.00
HP 8431A 2-4 GHz Band Pass Filter, N(m/f) $150.00
HP 8472A Crystal Detector, 10 MHz-18 GHz, negative polarity, SMA $175.00
HP 8494G-002 Programmable Step Attenuator, 0-11 dB, DC-4 GHz, SMA $350.00
HP 8495H-001 Programmable Step Attenuator, 0-70 dB, DC-18 GHz, N $400.00
HP 8496A-002 Step Attenuator, 0-110 dB, DC-4 GHz, SMA $375.00
HP 8497K-004 Programmable Step Attenuator, 0-90 dB, DC-26.5 GHz $750.00
HP K422A WR42 Flat Broadband Detector, 18.0-26.5 GHz $350.00
HP K532A WR42 Frequency Meter, 18.0-26.5 GHz $450.00
HP K752C WR42 Directional Coupler, 10 dB, 18.0-26.5 GHz $450.00
HP K752D WR42 Directional Coupler, 20 dB, 18.0-26.5 GHz $450.00
HP K870A WR42 Slide Screw Tuner, 18.0-26.5 GHz $275.00
HP K914B WR42 Moving Load, 18.0-26.5 GHz $300.00
HP Q752D WR22 Directional Coupler, 20 dB, 33-50 GHz $650.00
HP R382A WR28 Direct Reading Attenuator, 0-50 dB, 26.5-40 GHz $2,250.00
HP R422A WR28 Crystal Detector, 26.5-40 GHz $400.00
HP R532A WR28 Frequency Meter, 26.5-40 GHz $500.00
HP R752C WR28 Directional Coupler, 10 dB, 26.5-40 GHz $450.00
HP R752D WR28 Directional Coupler, 20 dB, 26.5-40 GHz $450.00
HP R914B WR28 Moving Load, 26.5-40 GHz $250.00
HP V365A WR15 Isolator, 25 dB, 50-75 GHz $750.00
HP V752D WR15 Directional Coupler, 20 dB, 50-75 GHz $650.00
HP X870A WR90 Slide Screw Tuner $150.00
HUGHES 45712H-1000 WR22 Frequency Meter, 33-50 GHz $900.00
HUGHES 45714H-1000 WR15 Frequency Meter, 50-75 GHz $900.00
HUGHES 45716H-1000 WR10 Frequency Meter, 75-110 GHz $900.00
HUGHES 45721H-2000 WR28 Direct Reading Attenuator, 0-50 dB, 26.5-40 GHz $1,000.00
HUGHES 45724H-1000 WR15 Direct Reading Attenuator, 0-50 dB, 50-75 GHz $1,000.00
HUGHES 45732H-1200 WR22 Level Set Attenuator, 0-25 dB, 33-50 GHz $250.00
HUGHES 45772H-1100 WR22 Thermistor Mount, -20 to +10 dBm, 33-50 GHz $400.00
HUGHES 45773H-1100 WR19 Thermistor Mount, -20 to +10 dBm, 40-60 GHz $650.00
HUGHES 45774H-1100 WR15 Thermistor Mount, -20 to +10 dBm, 50-75 GHz $750.00
HUGHES 45775H-1100 WR12 Thermistor Mount, -20 to +10 dBm, 60-90 GHz $800.00
HUGHES 45776H-1100 WR10 z Thermistor Mount, -20 to +10 dBm, 75-110 GH $850.00
HUGHES 47316H-1111 WR10 Tuneable Detector, 75-110 GHz, positive polarity $600.00
HUGHES 47741H-2310 WR28 Phase Locked Gunn Osc., 32.000 GHz, +18 dBm $2,000.00
HUGHES 47742H-1210 WR22 Phase Locked Gunn Osc., 42.000 GHz, +18 dBm $2,750.00
HUGHES 47974H-1000 WR15 SPST PIN Switch, 250 MHz speed, 60-62 GHz response $375.00
KRYTAR 2616S Directional Detector, 1.7-26.5 GHz, K(f/m)/SMC $200.00
M/A-COM 3-19-300/10 WR19 Directional Coupler, 10 dB, 40-60 GHz $450.00
MICA C-121S06 Circulator, 17.5-24.5 GHz, SMA(f/m/m) $75.00
MIDWEST MICROWAVE 3537 DC Block, 0.1-12.4 GHz, SMA(m/f) *NEW* $40.00
MINI-CIRCUITS ZFDC-20-4 Directional Coupler, 19.5 dB, 1-1000 MHz, SMA(f) $25.00
NARDA 3000-SERIES Directional Couplers $150.00
NARDA 3024 Bi-Directional Coupler, 20 dB, 4-8 GHz $375.00
NARDA 3090-SERIES Precision High Directivity Couplers $225.00
NARDA 368BNM Coaxial High Power Load, 500 Watts, 2.0-18 GHz, N(m) $500.00
NARDA 3752 Coaxial Phase Shifter, 0-180 deg./GHz, 1-5 GHz $1,000.00
NARDA 3753B Coaxial Phase Shifter, 0-55 deg./GHz, 3.5-12.4 GHz $1,000.00
NARDA 4000-SERIES SMA Miniature Directional Couplers $75.00
NARDA 4226-10 Directional Coupler, 10 dB, 0.5-18.0 GHz, SMA(f) $275.00
NARDA 4227-16 Directional Coupler, 16 dB, 1.7-26.5 GHz, 3.5mm(f) $325.00
NARDA 4242-20 Directional Coupler, 20 dB, 0.5-2.0 GHz, SMA(f) $100.00
NARDA 4247-20 Directional Coupler, 20 dB, 6.0-26.5 GHz, 3.5mm(f) $200.00
NARDA 4247B-10 Directional Coupler, 10 dB, 6.0-26.5 GHz, 3.5mm(f) $200.00
NARDA 5070-SERIES Precision Reflectometer Couplers $300.00
NARDA 562 DC Block, 10 MHz-12.4 GHz, 100 V max., N(m/f) $65.00
NARDA 765-10 10 dB Attenuator, 50 Watts, DC-5 GHz, N(m/f) $165.00
NARDA 768-10,-20 10 dB or 20 dB Attenuator, 20 Watts, DC-11 GHz, N(m/f) $120.00
NARDA 792FF Variable Attenuator, 0-20 dB, 2.0-12.4 GHz $375.00
NARDA 794FM Direct Reading Variable Attenuator, 0-40 dB, 4-8 GHz $375.00
OMNI-SPECTRA 2085-6010-00 Crystal Detector, 1-18 GHz, negative polarity, SMA(m/f) $50.00
PAMTECH KYG1014 WR42 Junction Circulator, 18.0-26.5 GHz $250.00
SONOMA SCIENTIFIC 21A3 WR42 Circulator, 20 dB, 20.6-24.8 GHz $75.00
TRG B510 WR22 Direct Reading Attenuator, 0-50 dB, 33-50 GHz $1,000.00
TRG V551 WR15 Frequency Meter, 50-75 GHz $600.00
TRG W551 WR10 Frequency Meter, 75-110 GHz $750.00
WAVELINE 100080 WR28 Terminated Crossguide Coupler, 30 dB $200.00
WEINSCHEL DS109 Double Stub Tuner, 1-13 GHz, N(m/f) $150.00
WEINSCHEL DS109LL Double Stub Tuner, 0.2-2.0 GHz, N(m/f) $150.00
HP 3780A-001 Pattern Generator / Error Detector, 1 kb/s - 50 Mb/s $1,000.00

COMMUNICATIONS

HP 59401A HPIB Bus Analyzer $375.00
MICRODYNE 1200MR 215-320 MHz Telemetry Receiver, PSK demodulation $750.00
TEK 1410R NTSC Gen., w/SPG2 sync. generator, TSG7 color bars $800.00
TEK 1411R PAL Gen.,w/SPG12 sync; TSG11 color bars;TSG13 linearity $750.00
TEK 1411R PAL Test Gen., w/SPG12,TSG11,TSG13,TSG15,TSG16 ..... $1,000.00
TEK 1411R PAL Test Gen., w/SPG12,TSG11,TSG12,TSG13,TSG15,TSG16 ..... $1,100.00
TEK 1411R-opt.04 PAL Test Gen., w/SPG12,TSG11,TSP11,TSG13,TSG15,TSG16 ..... $1,400.00
TEK 147A NTSC Test Signal Generator, with noise test signal $800.00
TEK 148 PAL Insertion Test Signal Generator $700.00
TEK 520A NTSC Vectorscope $750.00
TEK 521A PAL Vectorscope $750.00

MISCELLANEOUS

FLUKE 2180A RTD Digital Thermometer $500.00
HP 7090A Measurement Plotting System $1,500.00
P.A.R. 5206-95,98 Two-Phase Lock-in Amp., 2 Hz-100 kHz, GPIB $1,500.00
TEK TM5003 5000-series 3-slot Programmable Power Module $450.00
TEK TM5006 5000-series 6-slot Programmable Power Module $600.00
TEK TM504 500-series 4-slot Power Module $175.00
TEK TM506 500-series 6-slot Power Module $250.00
TEK TM515 500-series 5-slot Traveller Power Module $250.00

Write in 155 on Reader Service Card.

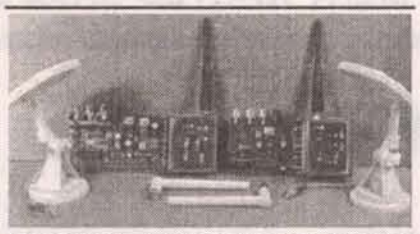
HAM GEAR FOR SALE

SECRETS OF RF CIRCUIT DESIGN From Joseph Carr, one of today's most respected electronics authors, comes this pragmatic, intermediate-level guide to designing, building, and testing all types of radio frequency circuits. Filled with functional projects that demonstrate the principles of RF circuits. Only $29.95! **10% discount to *Nuts & Volts* subscribers**. Call **1-800-783-4624** to order using Visa or MasterCard.

PRACTICAL ANTENNA HANDBOOK, by Joseph Carr. The most popular book on antennas ever written, widely known as "the antenna builder's bible." This *Third Edition* is a work for anyone with an interest in antennas, from the newest of novices to the most experienced engineer. This empowering book gives you all kinds of projects and material that explains why what you did works. Only $49.95! **10% discount to *Nuts & Volts* subscribers**. Call **1-800-783-4624** to order using Visa or MasterCard.

MINITOR II RF boards (NRB-6542A) 33.78 removed from working pagers some 2 channel. Large quantity, $45 or best offer. Call 302-838-1199.

WANTED: ROCKWELL-Collins HF-80 equipment, 851S-1, 237B-3 log periodic, Collins literature. Jim Stitzinger 805-259-2011, 805-259-3830 (fax), bfl-jfs@smartlink.net



ATV-2400, 2.4GHz 8 channel designed for legal use in ham bands. EZATV, www.4atv.com

LML RADIO & electronics. Let us be your one stop shop for all your used radio equipment, test equipment & other surplus stuff. For catalog, call 909-873-1319 or fax on demand 24 hr. 909-820-1885 & our web catalog: Http://members.aol.com/hrh6/LMLinc or LML, 424 E. Shamrock, Rialto, CA 92376.

THE SMART BATTERY CHARGER for lead acid or gel cell batteries. Can be left connected to the battery **INDEFINITELY**, will not overcharge! Standard kit is 12V @ 1 amp. This kit is 100% complete. For the kit order #150-KIT at $59.95. For an assembled and tested unit, order #150-ASY at $79.95. CA residents add 7.75% sales tax. Add $6.50 per unit shipping. MC/VISA accepted. A&A Engineering, 2521 W. La Palma #K, Anaheim, CA 92801. 714-952-2114, FAX 714-952-3280.

MIKEMASTER: A microphone preamplifier with noise gating & compression. Created by Marv Gonsior W6FR, March 1998 QST. Got noise get MikeMaster! For kit order #210-KIT at $69.95. Assembled & tested (specify Kenwood, ICOM, or Yaesu wiring) order #210-ASY at $89.95. Shipping for US & Canada is $6.50, others add 15%. CA residents add 7.75% sales tax. For info send legal size SASE to A&A Engineering, 2521 W. LaPalma #K, Anaheim, CA 92801. P 714-952-2114, Fax 714-952-3280.

HAM GEAR WANTED

ARC-5 RECEIVERS and original manuals. John Broussard, 312 Guilbeau, Breaux Bridge, LA 70517.

CB – SCANNERS

SALES & SERVICE: CB equipment, modification kits, meters, antennas, mics, radios, transistors, repairs & hard-to-find items. Complete list $4. D&R Electronics, 10 Park St., Thomaston, CT 06787. 860-283-9492 or RTed821836@aol.com

HALCON COMMUNICATIONS Wholesale only: Cobra, Uniden, Midland, Galaxy, CTE, Super Star, Kenwood, Yaesu, Icom. Free catalog, Free call 1-800-683-6999.

CB MODIFICATIONS! Frequencies, books, kits, high-performance accessories, plans, repairs, amplifiers, 10-meter conversions. The best since 1976! Catalog $3. CBCI, Box 1898NV, Monterey, CA 93942. www.cbcintl.com

SHOOTING STAR, Palomar, Superstar, Galaxy, Uniden, Cobra, exports, police & fire & military scanners, microphones, power supplies, antennas, modifications, repairs, more!! 15 yrs. in same location, 5 page picture price sheets $1 (refundable). Galaxy, Box 1202, Akron, OH 44309. (Also, Red Devil & Messinger Products.)

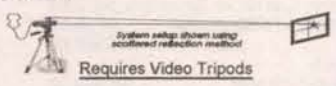
AMAZING DEVICES

NV1099O

See and Order from Our "Action" Web Site at:http://www.amazing1.com

Laser Window Bounce Listening System

Demonstrates a Remarkable Concept allowing you to listen to sounds picked up from a reflecting surface illuminate by a laser. This is accomplished by listening to these varying light reflections or scatter with a sensitive optical receiver. Low cost science project and demonstration systems use our visible red lasers and LLR series low noise ultra-sensitive optical receivers with built in voice enhancement filters. Infra red lasers provide far better performance but require precise initial optical alignment. Actual use is illegal!



Requires Video Tripods

LWB9 Plans and all Data for 3 Laser Window Bounce Systems.....$20.00
LWB6K Kit of Complete 100' System for Demo/Science Project $129.50
LWB60 Above System With Assembled Electronics.....$159.50
Those With Lasers Only Need Our: **#LLR3K** Optical Receiver Kit.....**$69.50** or **#LLR30** Ready to Use Optical Receiver.....**$99.50**

For Those Wishing to Build a High Performance System, We Offer the Below Modules Requiring Housing And Optics
***LLR4O** Receiver.....**$199.50** ***CWL10** 10 mw Class IIIB invisible IR Laser.....**$149.50** **Higher powered lasers available**

500KV Stun Gun!!

Intimidatingly effective up to 20' with explosive spark discharge. Easily consealable

SIZZ500.....**$79.95**

Air Taser Gun

More stopping power than most hand guns!! 15 foot knock down range. Easily concealed Uses non lethal technology.

ECG10 Ready to Use.....**$239.95**

Gravity Motor

Electrical charge reactions produce the effect of "anti gravity. You build a model craft from simple parts and levitate it with our ion power source. Battery or 115vac operation. Great science or fascinating research project includes our gravity handbook.

GRA3 Plans/Book.....**$20.00**
GRA3K Power Source Kit.....**$99.50**
GRA30 Assembled Above.....**$149.95**

Tesla Coil

Produces 30" Sparks

Create a spectacular display of nature own lightning. Many amazing experiments possible. **See in action on our web site!!**

BTC4 Plans..**$20.00**
BTC4K kit....**$899.95**
BTC40 Ready to use.....**$1199.95**
Smaller Version (8-10" Sparks)
BTC3 Plans..**$15.00** **BTC3K** Kit.**$349.95**
BTC30 Ready to Use.....**$449.95**

Ion Ray Guns

Star Wars Technology Directs Energy

Star Wars Technology Demonstrates Weapons Potential, Force Fields, IonMotors, Antigravity etc. ***Projects electric shocks without contact!!*** Conduct many weird and bizarre experiments. Handheld battery operated and easy to operate.

IOG7/9 Plans.....**$10.00**
IOG7K Kit/Plans.....**$99.50**
IOG70 Assembled/Tested.....**$149.95**
Higher Powered Device
IOG9K Kit/Plans.....**$129.95**
IOG90 Assembled/Tested.....**$199.95**

6 FM Xmtr Kits!

1. Super Sensitive Ultra Clear 1 Mile+ Voice Transmitter.
2. 1 Mile+ Telephone Transmitter.
3. Line Powered Phone Transmitter Never Needs Batteries!!
4. Tracking/Homing Beacon Beeping Transmitter
5. Video/Audio Rebroadcaster 1 Mi.
6. TV/FM Radio Disrupter. Neat Prank! Discretion Required

Includes Hints Using Wireless Devices
COMBOX Above 6 Kits/Plans.....**$59.95**
COMBOP Above 6 Plans Only.....**$10.00**

TAKE CONTROL Using Electronic Hypnosis

Electronic circuitry induces hypnotic as well as ALPHA relaxed mind states. Place subjects under your control

HYP2 Plans.....**$10.00**
HYP2K Kit/Plans.....**$49.95**
HYP20 Ready to Use.....**$69.95**

MIND2 Plans for Mind Control..**$15.00**
MIND2K Kit/Plans.....**$49.95**
MIND20 Ready to Use.....**$79.95**

Pain Field Pistol

Caution! Do not aim at people!

Blast out rodents with high power ultrasonics.

Handheld and battery operated with all controls.

Rental units available.

PPP1 Plans.....**$8.00**
PPP1K Kit/Plans.....**$49.95**
PPP10 Ready to Use.....**$79.95**

Shock Force Field Vehicle Object Electrifier

Hand shock balls,wands. Mini circuit is easily hidden. Great payback for those wise guys.

SHK1K Kit/plan.....**$19.95**

Theramagnetic Pulser™

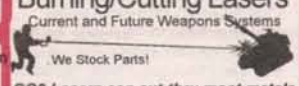
Complex Magnetic waves are claimed to produce many health benefits. Board level experimental device is sold for research purposes only.

THMAG10 Lab Assembled....**$24.95**

Burning/Cutting Lasers

Current and Future Weapons Systems

We Stock Parts!



CO2 Lasers can cut thru most metals
LC3 Plans Poor Mans System...**$15.00**
LC7 Plans Lab System 30W+....**$20.00**

Nd Glass/Yag/Ruby can blast holes thru most metals using pulses.
LAGUN2 Plans 6kw Pulses.....**$20.00**

Cybernetic Ear!

Provides that "extra edge" for many listening applications. Enhances 3 to 4x of normal.

CYBEREAR.....**$19.95**

Hover Board

28 pages of data related to the most revolutionary advance in transportation. Cutting edge R&D

HOVER Plans and Data.....**$25.00**

Build a Magnetic Cannon!!!

Experiment with and Construct Rail Guns, Magnetic Launchers, Coil and Sleeve Guns, Super High Gravity Pulses, Explode Wires and Water, Antigravity, Levitation, Mass Warping, Magnetic Can Crushing, Plasma Propulsion, High Energy Radio Frequency Guns (Hert), EMP, Lattice Snapping, and all Types of Electrical Pyrotechnics. Plus Much More!!

- ***Lossless Charging***
- ***Programmable Energy Control***
- ***Up to 16 Kilojoules at 4 Kilovolts***
- ***Triggered Spark Switch***
- ***12 VDC/115 VAC Operation***

Unit is Shown With Our "Distributed Energy Source"

HEP3 Plans 500-1Kj @ 1-2 Kv .....**$15.00** **HEP3K** Kit/Plans with 500 Joules.....**$349.50**
HEP30 Assembled Above.....**$449.50** **Custom Designs Available on Request**

Related Projects Using Pulsed Magnetics

HEP9 Plans Higher Powered 1-16 Kj @ 1-4 Kv.....**$20.00**
PPRO1 Plasma Gun Plans Shoots a High Velocity Projectile. *Exploding Wire* **$20.00**
MASS1 Mass Launcher / Kinetic Gun / Electric Cannon. *Ultra Accelerative Forces* **$20.00**
CANCRUS1 Can Crusher/ Mass Warping plans. *Distort Mass and Shape* **$15.00**
EGUN1 Build a High Velocity Kinetic Electric Gun.....**$20.00**

Mini TESLA Coil

Lights up a 4' fluorescent tube-all without any contact!! Yet only 3" tall!

MTC1K Kit/Plans.....**$24.50**
MTC10 Assembled.....**$34.50**

Transistorized TESLA Coil

Amazing and bizarre effects turn a normal light bulb into a spectacular plasma display!! With adjustable frequency control. Safe 12vdc input

TCL5 Plans..**$8.00** **TCL5K** Kit/Plans..**$59.50**
TCL50 Assembled and Tested.....**$99.50**

Jacobs Ladder

Pyrotechnical traveling fiery plasma expands over 3" before evaporating into space. Solid state circuitry with adjustable arc control. 115/230 volt operation. Uses safe high frequency energy.

JACK1 Plans.....**$8.00**
JACK1K Supply, Mtg Blks, Ladders..**$149.95**
JACK10 Ready to Use.....**$249.95**

PLASMA FIRE SABER

Patented Moving Light Concept Defies all Logic as it Appears to Evaporate into Space!!

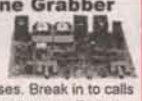
Replaceable Blades, Overide Switch
Interactive Sound Module
Available on Request

Available colors: "C" *photon blue, starfire red phaser green, neon red*

MINISAB "C" 15" Active Length.....**$49.95**
SAB24 "C" 24" Active Length.....**$69.95**
***SAB30** "C" 30" Active Length.....**$89.95**
***SAB36** "C" 36" Special Request.....**$119.95**
Please add $10.00 for special handling and specify color

Telephone Line Grabber

Room Listener Controller and Call Diverter

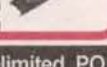


Listen to your premises. Break in to calls Control household appliances. Remote dial long distance calls-from anywhere!!

TELCON4 Plans.....**$10.00**
TELCON4K Kit/Plans.....**$99.50**
TELCON40 Ready to Us.....**$149.59**

Attention! High Voltage Modules

Battery powered for hovercraft, plasma guns, anti gravity, force fields, pyrotech



MIMIMAX4 4KV...**$19.50**
MINIMAX3 3KV...**$17.50**
MINIMAX2 2KV...**$14.50**

3 Mi FM Voice Transmitter

Crystal clear performance. Many applications. Easy to assemble

FMV1 Kit and Plans.....**$39.50**

Information Unlimited PO Box 716 Amherst N.H. U.S.A. 03031
1 800 221 1705 Orders/Catalogs Only! Fax 1 603 672 5406 Information 1 603 673 4730 *Free Catalog on Request*
Pay by MC,VISA,Cash, Check, MO, COD. Add $5.00 S&H plus $5.00 if COD. Overseas Contact for Proforma

Write in 29 on Reader Service Card.

• ECLIPSE • PANASONIC • SILENT WITNESS • VIDEOLARM • SONY • SAMSUNG • PELCO • RAINBOW • SPECO/CSI • GBC • CHUGAI/COMPUTAR • ATV • NVT • PHILIPS • BURLE • JVC •

MONITOR
$93.00
BLACK & WHITE
12" 1000 LINES
ECL - 1202
MANY SIZES AVAILABLE

BLACK & WHITE BULLET CAMERA
WATERPROOF
$79.00
420 LINES
.1 LUX
ECL - 377

FES
FUSION ELECTRONIC SECURITY
1-800-323-8746
WEBSITE : WWW.FUSIONELECTRONICS.COM
E-MAIL : FUSION@FUSIONELECTRONICS.COM
1376 NW 22 AVE.
MIAMI, FL 33125
TEL (305)635-7060
FAX (305)635-3175

4 CHANNEL RECIEVER
$135.00
2.4 GHZ
WITH POWER SUPPLY
ECL - 2400SR

ALUMINUM WALL BRACKET
13" ADJUSTABLE P/T
ECL - 205
$12.00

DIGITAL COLOR CAMERA
DIGITAL COLOR (DSP)
350 LINES
2 LUX
ECL - 551
$99.00

MINI DIGITAL COLOR CAMERA
350 LINES
ECL - 554
2 LUX
METAL HOUSING
$98.00

COLOR MICRO BOARD CAMERA
DIGITAL (WITH DSP)
350 LINES
32 MM X 32 MM
2 LUX * PINHOLE LENS
ECL - 456P
$87.00

2.4 GHZ VIDEO TRANSMITTER
1000' * 4 CHANNELS
ECL - 2400MT
2.5"L X 1.5"W X .5"H
$89.00

BLACK & WHITE MINI DOME
3.5" * 420 LINES
.1 LUX
ECL - 372
$59.00

OUTDOOR ALUMINUM HOUSING
WITH HEAT SHIELD
ECL - 601S
$34.00

BLACK & WHITE CAMERA
420 LINES
.1 LUX
ECL-371
$65.00

BLACK & WHITE MICRO BOARD CAMERA
$38.00
420 LINES
32MMX32MM
.1 LUX
ECL - 11P
PINHOLE LENS

WE HAVE MONTHLY SPECIALS!

PIR CAMERA
HIDDEN (COVERT)
420 LINES
.1 LUX
WORKING PIR
$96.00

PHONE OR FAX US TO BE PLACED ON OUR MAILING LIST

PLASTIC WALL BRACKET
7" ADJUSTABLE P/T
ECL - 206
$4.85

MINI METAL BRACKET
$6.50
SWIVEL HEAD CAMERA MOUNT
ECL - 203AL

• ECLIPSE • PANASONIC • SILENT WITNESS • VIDEOLARM • SONY • SAMSUNG • PELCO • RAINBOW • SPECO/CSI • GBC • CHUGAI/COMPUTAR • ATV • NVT • PHILIPS • BURLE • JVC •

240+ CHANNEL CB/HAM/COMMERCIAL radios: AM/FM/SSB/CW export/domestic: RCI, Motorola, Uniden, Cobra, Alinco, Kenwood. Mics, antennas, linears, meters, books, night scopes, and tons more stuff! Catalog $3. MAXTECH, Box 8086, New York, NY 10150. 718-547-8244.

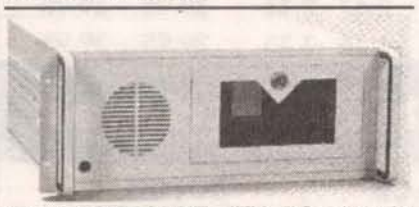
MUSIC & ACCESSORIES

COMPUTER HARDWARE

WE CARRY a variety of cables, switch boxes, accessories, and adapters to connect PCs, printers, Mac's, networks, telecommunications, and audio/video equipment. We offer: custom cables, free catalogs, and same day shipping on most orders. Visit our website at www.rogerssystems.com or call 1-800-366-0579.

CRTs CHEAP. Buy direct from the manufacturer. Save money. Mfg. all CRT types since 1950. **3 year warranty**. Reg-Res 19" tubes $75; 25" $100; hi-res 13" tubes from $80. We specialize in **hi-resolution** video/computer CRTs. **T.M.C.** 215-226-0749/215-223-0388.

433MHz INTEL CELERON/A 128K cache CPU and Pentium II motherboard super combo deal including AGP 3D 8MB video, 3D 32 voice PCI digital sound, 1 floppy, 2 UDMA/66 IDE, serial/parallel, USB, IF and PS2 ports, 56K modem/FAX/voicemail, 10/100 LAN, ATX or normal power connectors, CD-ROM disc w/drivers & many FREE applications software, 2 year motherboard warranty, only $179. Order now 847-657-1160 or www.saveware.com



19" RACKMOUNT ATX PC chassis, $169 (with ad). 972-242-8087, www.cti-tx.com

450MHz BAREBONE systems from $250. 486 computers $99. Brand name Pentiums from $199. Color printers $75, portable printers $75, motherboards $20, 1.44/1.2 floppies, speakers $10. Call 714-778-0450.

LASERS & ACCESSORIES

HELIUM NEON LASERS
- Complete Systems
- Plasma Tubes
- Power Supplies

ACCESSORIES
- Optics
- Electro-Optics
- IR Viewers
- Books & More

DIODE LASERS
- Visible / IR
- Complete Modules
- Collimating Optics
- Drive Circuits

FREE CATALOG
WEB SITE:
www.mi-lasers.com

MEREDITH INSTRUMENTS

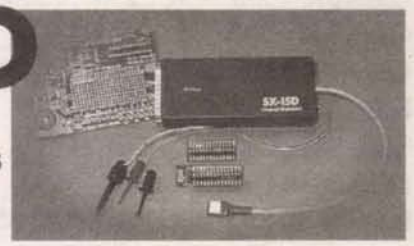
Phone: 623-934-9387 • Fax: 623-934-9482

Write in 30 on Reader Service Card.

SX Debugger+Programmer

SX-ISD

The ultimate tool for the 100mhz SX microcontrollers - Qualified by Scenix Semiconductor



- In-system debugger for SX18/20/28/48/52
- Built in programmer
- Real-time in-system code execution
- Full speed emulation
- Real-time breakpoint
- Frequency synthesizer from 25khz to 75mhz
- Source level debugging for SASM, SXC
- Selectable internal frequencies
- External break and clock inputs
- Conditional animation break
- Software animation trace
- Parallel port interface
- IDE runs under Win 95/98/NT
- Comes with SASM Assembler, SXDEMO board, SX28AC device and 18-pin, 28-pin SDIP headers

$375

Also Available

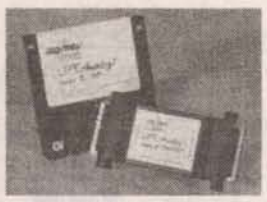
PGM2000 Gang Programmer
- Stand alone 8 gang programmer
- Parallel Port Interface for on-line operation
- Different 8-socket program adapters to support DIP, SOIC, SSOP, TQFP, PQFP packages
- Adjustable programming voltages in 0.1V
- Codes and fuse reside securely in EEPROM of Master Control Unit
- Comes with Win 95/98/NT software
- Also supports other processors
- From $900

PGM-SX Programmer
- Parallel Port Interface
- 40-pin ZIF socket to carry device to be programed or program in-circuit
- Comes with Win 95/98/NT software
- Comes with SASM assembler
- Optional SOIC, SSOP, TQFP and PQFP programming sockets
- PGM-SX $149, SMT adapters $120

Advanced TransdAtA CORPORATION
14330 Midway, #128, Dallas, Texas
Tel 972.980.2667 Fax 972.980.2937
Email: atc1@ix.netcom.com

www.adv-transdata.com

Write in 31 on Reader Service Card.



LOW-COST 12-BIT A/D KITS. $59 LPT: Analog! PC printer-port interface acquires 8 analog signals. Also features two 12-bit D/As, current sources for sensor excitation and digital I/O lines. QuickBasic and VB software included. 1-channel A/D only $39. http://www.tgn.net/~adnav/ or E-Mail: adnav@tgn.net

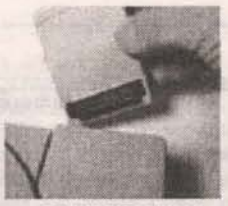
PC CABLES: http://www.cablesusa.com 100s of hard-to-find new cables and parts, pictures, free technical information. Low prices, RS232, SCSI, keyboard, network, VGA, Cat-5, USB, Firewire, fast secure online ordering & browsing. 954-418-0817.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.,** 937-847-2300 OR fax 937-847-2350.

WINDOWS 95B only $49! Includes CD, boot floppy, and certificate. (Super Price!) Windows 98SE only $119! Includes CD, manual, boot floppy, and certificate. (Second Edition!) Order now 847-657-1160 or on-line www.save ware.com

EVERYTHING NEW w/warranty! Motherboards with CPU 450MHz $195, monitors 15" $125, Pentium systems from $195. Modems, multimedia kits, scanners, hard drives 540 megabytes $35, 2.5 gigabytes $65. Call 714-778-0450. E-Mail: cci@surfside.net

433MHz PII system with Intel CELERON/A 128K cache MMX CPU, 4.3 gigabyte hard drive, 48X CD-ROM, 1.44 floppy, 32 megabytes SDIMM memory, 8MB AGP 3D video, 56K modem/voice/fax, 32 voice 3D sound, 360 watt speakers, multimedia keyboard, Internet mouse, ATX case, 2 year parts and labor warranty! Only $499! Everything installed with FULL versions WIN95B $39, WIN98SE $119. Order now 847-657-1160 or on-line www.save ware.com



SONY PLAYSTATION GAME ENHANCER, mod-chip function plays backup COPY of CD. You do not need to have original loaded to play backup. Simply plug the enhancer in back of playstation! Skips both Sony logos, many preloaded cheat codes, add more from Internet. Memory management, view video/movie files from CD, PC computer link port $29. Quantity prices available. 240 save game memory card $25. Order now 847-657-1160 or on-line www.save ware.com

Tired of Expensive Inkjet Cartridges ?

Save 90% on Inkjet Inks !

Printer	# of Refills		Cost/Refill		Kit Price	
	Black	Color	Black	Color	Black	Color
HP 500 Series, 400, Officejet 300, 350, Fax	7	14	**4.71**	**2.85**	32.95	39.95
HP 600 Series, Officejet 500, 570, 600	7	14	**4.71**	**3.21**	32.95	44.95
HP 820C, 855C, 870C, 1000C, 1150C, Copier 120, 210	6	12	**6.67**	**3.33**	39.95	39.95
HP 720C, 722C, 712C, 880C, 890C, 895C 1120C, 1170C	6	12	**6.67**	**3.75**	39.95	44.95
Canon BJ-10, 200, 210, 240, 250 Apple SWriter 1200, 1500	14	20	**2.15**	**2.00**	29.95	39.95
Canon BJC-4000 Series, C2500, C3000, C3500, C5000	60	60	**0.50**	**0.67**	29.95	39.95
Canon BJC-6000	**14**	**8**	**2.85**	**1.67**	**39.95**	**39.95**
Canon BJC-600, 610, 620 Apple SWriter Pro	20	13	**1.50**	**3.07**	29.95	39.95
Epson Stylus Color, Color Pro, Pro XL	12	12	**2.50**	**3.33**	29.95	39.95
Epson Stylus Color II, IIs, 1500 (Black)	15	15	**2.00**	**2.66**	29.95	39.95
Epson Stylus Color 500, 200	20	17	**1.50**	**2.35**	29.95	39.95
Epson Stylus Color 400, 600, 800, 850, Photo	20	17	**1.50**	**2.65**	29.95	44.95
Lexmark JP 1000, 1020, 1100, ExecJet II, IIc, Medley 4C	10	17	**3.00**	**2.35**	29.95	39.95
Lexmark JetPrinter 5700, 5000, 7000, 7200, 3200	15	17	**2.67**	**2.35**	39.95	39.95
Compaq IJ700, IJ900, Xerox XJ8C, XJ9C	15	17	**2.67**	**2.35**	39.95	39.95
Xerox Home Center 450C, XJ6C Inkjet	22	12	**1.36**	**3.33**	29.95	39.95

SAVE 30 - 50% on New Compatible Cartridges!

Printer (CALL FOR OTHERS NOT LISTED)	BLACK CARTRIDGE	COLOR CARTRIDGE
Canon BJC-4000 Series, C2500, C3000, C3500, C5000	$5.50	$12.95
Apple StyleWriter 2400, 2500	$5.50	$12.95
Canon BJC-600, 610, 620 Apple StyleWriter Pro	$4.95 (9cc)	$4.95 @ (9cc)
Hi-Capacity Canon BJC-600, 610, 620	**$5.95 (15cc)**	**$5.95 @ (12cc)**
Canon BJC-70, BJC-80	$9.95 (3-pak)	$14.95 (3-pak)
Epson Stylus Color, Color Pro, Pro XL NEW PRICING	**$10.95**	**$17.95**
Epson Stylus Color II, IIs	**$12.95**	**$17.95**
Epson Stylus Color 500, 200	**$12.95**	**$17.95**
Epson Stylus Color 400, 600, 800, 850,1520, Photo	**$12.95**	**$17.95**
Epson Stylus Color 440, 640, 740	**$12.95**	**$17.95**

- **BULK Inks, Refill Accessories**
- **Glossy card stock & Coated Paper**
- **School & Government PO's Welcome**
- **2 - 3 Day Shipping**

Quality Inks for:
HP • Epson • Lexmark
Canon • Apple • DEC

Inkjet Southwest

VISA

Call or see us online!

Monday - Friday
8:30 - 5:30 PST 11:30 - 8:30 EST

www.inkjetsw.com **1-800-447-3469**

(480) 668-1069 Fax (480) 668-0959

COMPUTER SOFTWARE

FREE IBM DISK CATALOG of quality Shareware and CD-ROMs. **MOM 'N' POP'S SOFTWARE** <ASP>, PO Box 15003-N, Springhill, FL 34609-0111. 352-688-9108. momnpop@gate.net

UNDERGROUND CDs: Health, hacking, phreaking, free energy, anti-gravity, time travel, many incredible electronic devices, and MP3 stuff: **www.hi-tech stuff.com**

CAM & MOTION SW/HW: Z-trace, PCB toolpath. Plotcam motion control, step drivers. **www.megabits.net/ddt** MSG/FAX 407-452-7197, 407-459-2729. **Heater@megabits.net**

MICROSOFT OFFICE97 Professional Edition. New factory sealed, unopened. **WORD, EXCEL, POWERPOINT, ACCESS** and **OUTLOOK** included. CD only. **ONLY $49.95! FREE SHIPPING!** Quantity discounts available. brucesulli van@msn.com

LIQUIDATION WINDOWS 95/98, Office suites $10-69. 1,000 games $25. Windows 98 book $10. 714-778-0450.

COMPUTER EQUIPMENT WANTED

WANTED: FOR historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

Write In 32 on Reader Service Card.

HP CALCULATORS wanted: models 10, 70, calculator watch, others for private collection. Cash paid. Bob Morrow, 765-855-2348, rkmorrow@aol.com

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 937-847-2300 OR fax 937-847-2350.

WANTED: TERMINALS + PRINTERS: DEC, Wyse, IBM, ADDS, Okidata, Data South, Epson, C.ITOH, etc. Call for quote on any surplus computer equipment. Call Jeremy, 603-673-8077.

TEST EQUIPMENT

TEKTRONIX DC5010 350MHz counter, $400; HP 606B sig. gen., $250; GR1606A RF bridge, $250; Wavetek 5081. 1 step attenuator DC-1GHz, 0-81db, 10, 1, .1db steps, 50 ohm, $100; HP K422A detector, $150; Tektronix LC130, LC meter, $150; Krohn-Hite 3323 solid state variable, hi pass low pass, band reject dual filter 10Hz-100KHz, $450; Wavetek 182A 4MHz function gen., $150; HP 5004A signature ana., $150. A-Comm Electronics 303-341-2283, fax 303-341-2293, sales@a-comm.com

FEITEK PROVIDES repair, calibration and traceable certifications of test equipment. Free estimates. We buy, sell and trade all makes of test equipment. Visa and MasterCard accepted. Check out our inventory and specials at WWW.FEITEK.COM 2752 Walton Road, St. Louis, MO 63114, 314-423-1770.

KENTRONIX TEST EQUIPMENT SPECIALS. Check our WEB site at **http://www.kentronix.com** for monthly specials. We are also looking to buy test equipment, coaxial and waveguide components, manuals, etc. Contact Brian at 732-681-3229 or FAX 732-681-3312. E-Mail: brian@kentronix.com

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 937-847-2300 OR fax 937-847-2350.

POOR MAN'S Spectrum Analyzer/Monitor Receiver Kit. 2 to 1,700 MHz. Basic kit only $98. Now available with switched resolution filters, tracking generator and direct digital frequency readout. Works with ANY scope or IBM compatible computer. Send stamped envelope for details. Science Workshop, Box 310B, Bethpage, NY 11714. http://www.science-workshop.com

TEST EQUIPMENT for sale/wanted (NEW/USED): RF, Microwave, video and fiber optic. Cable TV, Broadcast TV, satellite and related industries. Wavetek, Tektronix, Hewlett Packard and other manufacturers. Spectrum analyzers, signal level meters, sweep systems, TDRs, OTDRs, and much more. **PTL Test Equipment, Inc**. Phone 561-747-3647 FAX 561-575-4635. E-Mail: PTLTE@aol.com http://www.PTLTEST.com

TEST EQUIPMENT: HP 3585A spectrum analyzer $3,500; HP 141T/8552B/8553B $650; HP 8443A $165; HP 5327C counter $40. 301-977-7408.

FLUKE 540B: Thermal transfer standard 0.25 to 1000 VRMS min ± 0.01%, $350; Fluke, as new 1921A True RMS voltmeter, $150. 2280B data logger lots of options, $400. Psitech Plus 707-745-4804. Check our new www.psitech-plus.com

POWER METERS: Wavetek 1034A, 10MHz-20GHz, +10, -50dbm AC with rechargeable new battery, $450; HP 436A, 8484A, opt 022, $1,000; HP 432A, 8478B, $400; Pacific measurements 1009, $150; Pacific measurements 1036, -40, +10dbm, $150. A-Comm Electronics 303-341-2283, fax 303-341-2293, sales@a-comm.com

WE BUY & sell test & measurement equipment. http://www.a-comm.com

HP 4944A, TIMS, $400; HP 5423A structural dynamics ana., $1,000; Tektronix 620 XY display, $300; HP 461A, $150; HP 465A, $150; HP 7475A, RS232 plotter, $150. A-Comm Electronics 303-341-2283, fax 303-341-2293, sales@a-comm.com

DISTORTION, ANAs: HP 339A, $1,000; HP 334A, $400; HP 331A, $250; modulation anas., HP 8901A, $900; HP 8901B rear inputs, $1,200. A-Comm Electronics, 11891 E. 33rd Ave., Unit C, Aurora, CO 80010, 303-341-2283, fax 303-341-2293.

TEKTRONIX 2465DVS, has **every** option: Multimeter, counter, TV, GPIB, $1,900. 408-292-5087.

AILTECH EATON NM37/57A EMI receiver 30MHz-1000MHz, $1,000; HP 8640B, $1,000; HP 8640B opt 02, $1,500; HP 8165A programmable signal source 1milhz-50MHz, HPIB, $900; HP 8620C, 86290B, 2-18.6GHz, sweeper and frame, $2,200; PTS 040 .1-40MHz synthesizer, $500; PTS 200 1-200MHz freq synthesizer, $600; HP 4935A TIMS, $900; Sencor SC61 wave ana. 0-60MHz scope freq and PK-PK digital read out useable to 100MHz, $450. A-Comm Electronics 303-341-2283, fax 303-341-2293.

RAMSEY Cool Wireless Goodies

World's Smallest TV Transmitters

We call them the 'Cubes'.... Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies - that's a nickel in the picture! Transmits color or B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Audio units include sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Any of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air! These are the units that are being built into hats, pagers, cigarette packs and sold for big $$!!

C-2000, Basic Video Transmitter.....$89.95 **C-3000, Basic Video & Audio Transmitter.....$149.95**
C-2001, High Power Video Transmitter...$179.95 **C-3001, High Power Video & Audio Transmitter....$229.95**

Doppler Direction Finder

Track down jammers and hidden transmitters with ease! This is the famous WA2EBY DF'er featured in April 99 QST. Shows direct bearing to transmitter on compass style LED display, easy to hook up to any FM receiver. The transmitter - the object of your DF'ing - need not be FM, it can be AM, FM or CW. Easily connects to receiver's speaker jack and antenna, unit runs on 12 VDC. We even include 4 handy home-brew "mag mount" antennas and cable for quick set up and operation! Whips can be cut and optimized for any frequency from 130-1000 MHz. Track down that jammer, win that fox hunt, zero in on that downed Cessna - this is an easy to build, reliable kit that compares most favorably to commercial units costing upwards of $1000.00! This is a neat kit!!

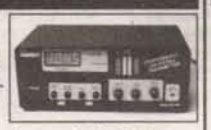
DDF-1, Doppler Direction Finder Kit $149.95

CCD Video Cameras

Top quality Japanese Class 'A' CCD array, over 440 line line resolution, not the off-spec arrays that are found on many other cameras. Don't be fooled by the cheap CMOS single chip cameras which have 1/2 the resolution, 1/4 the light sensitivity and draw over twice the current! The black & white models are also super IR (Infra-Red) sensitive. Add our invisible to the eye, IR-1 illuminator kit to see in the dark! Color camera has Auto gain, white balance, Back Light Compensation and DSP! Available with Wide-angle (80°) or super slim Pin-hole style lens. Run on 9 VDC, standard 1 volt p-p video. Use our transmitters for wireless transmission to TV set, or add our IB-1 Interface board kit for audio sound pick-up and super easy direct wire hook-up to any Video monitor, VCR or TV with A/V input. Fully assembled, with pre-wired connector.

CCDWA-2, B&W CCD Camera, wide-angle lens $69.95
CCDPH-2, B&W CCD Camera, slim fit pin-hole lens..... $69.95
CCDCC-1, Color CCD Camera, wide-angle lens $129.95
IR-1, IR Illuminator Kit for B&W cameras $24.95
IB-1, Interface Board Kit..... $14.95

Super Pro FM Stereo Transmitter



Professional synthesized FM Stereo station in easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set freq with Up/Down buttons, big LED display. Input low pass filter gives great sound (no more squeals or swishing from cheap CD inputs!) Limiters for max 'punch' in audio - without over mod, LED meters to easily set audio levels, built-in mixer with mike, line level inputs. Churches, drive-ins, schools, colleges find the FM-100 the answer to their transmitting needs, you will too. Great features, great price! Kit includes cabinet, whip antenna, 120 VAC supply. *We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.*

FM-100, Pro FM Stereo Transmitter Kit $249.95
FM-100WT, Fully Wired High Power FM-100..... $399.95

FM Stereo Radio Transmitters

No drift, microprocessor synthesized! Excellent audio quality, connect to CD player, tape deck or mike mixer and you're on-the-air. Strapable for high or low power! Runs on 12 VDC or 120 VAC. Kit includes case, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized Stereo Transmitter Kit $129.95

Lower cost alternative to our high performance transmitters. Great value, easily tunable, fun to build. Manual goes into great detail about antennas, range and FCC rules. Handy kit for sending music thru house and yard, ideal for school projects too - you'll be amazed at the exceptional audio quality! Runs on 9V battery or 5 to 15 VDC. Add our matching case and whip antenna set for nice 'pro' look.

FM-10A, Tunable FM Stereo Transmitter Kit..... $34.95
CFM, Matching Case and Antenna Set $14.95
FMAC, 12 Volt DC Wall Plug Adapter..... $9.95

Mini Radio Receivers

Imagine the fun of tuning into aircraft a hundred miles away, the local police/fire department, ham operators, or how about Radio Moscow or the BBC in London? Now imagine doing this on a little radio you built yourself - in just an evening! These popular little receivers are the nuts for catching all the action on the local ham, aircraft, standard FM broadcast radio, shortwave or WWV National Time Standard radio bands. Pick the receiver of your choice, each easy to build, sensitive receiver has plenty of crystal clear audio to drive any speaker or earphone. Easy one evening assembly, run on 9 volt battery, all have squelch except for shortwave and FM broadcast which has handy SCA output. Add our snazzy matching case and knob set for that smart finished look.

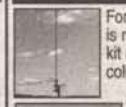
AR-1, Airband 108-136 MHz Kit..... $29.95
HFRC-1, WWV 10 MHz (crystal controlled) Kit $34.95
FR-1, FM Broadcast Band 88-108 MHz Kit..... $24.95
FR-6, 6 Meter FM Ham Band Kit $34.95
FR-10, 10 Meter FM Ham Band Kit..... $34.95
FR-146, 2 Meter FM Ham Band Kit..... $34.95
FR-220, 220 MHz FM Ham Band Kit..... $34.95
SR-1, Shortwave 4-11 MHz Band Kit..... $29.95
Matching Case Set (specify for which kit)..... $14.95

Tiny Transmitters

Gosh, these babies are tiny - that's a quarter in the picture! Choose the unit that's best for you. FM-5 is the smallest tunable FM transmitter in the world, picks up a whisper 10' away and transmits up to 300'. Runs on tiny included watch battery, uses SMT parts. FM-4 is larger, more powerful, runs on 5-12 volts, goes up to a mile. FM4,5 operate in standard FM band 88-108 MHz. FM-6 is crystal controlled in 2 meter ham band, 146.535 MHz, easily picked up on scanner or 2 meter rig, runs on 2 included watch batteries. SMT (surface mount) kits include extra parts in case you sneeze & loose a part!

FM-4MC, High Power FM Transmitter Kit $17.95
FM-5, World's Smallest FM Transmitter Kit..... $19.95
FM-6, Crystal Controlled 2M FM Transmitter Kit ... $39.95
FM-6, Fully Wired & Tested 2M FM Transmitter $69.95

FM Station Antennas



For maximum performance, a good antenna is needed. Choose our very popular dipole kit or the Comet, a factory made 5/8 wave colinear model with 3.4 dB gain. Both work great with any FM receiver or transmitter.

TM-100, FM Antenna Kit $39.95
FMA-200, Vertical Antenna $114.95

AM Radio Transmitter

Operates in standard AM broadcast band. Pro version, AM-25, is synthesized for stable, no-drift frequency and is setable for high power output where regulations allow, typical range of 1-2 miles. Entry-level AM-1 is tunable, runs FCC maximum 100 mw, range 1/4 mile. Both accept line-level inputs from tape decks, CD players or mike mixers, run on 12 volts DC. Pro AM-25 includes AC power adapter, matching case and bottom loaded wire antenna. Entry-level AM-1 has an available matching case and knob set that dresses up the unit. Great sound, easy to build - you can be on the air in an evening!

AM-25, Professional AM Transmitter Kit $129.95
AM-1, Entry level AM Radio Transmitter Kit..... $29.95
CAM, Matching Case Set for AM-1..... $14.95

RF Power Booster

Add muscle to your signal, boost power up to 1 watt over a freq range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat finished look, add the nice matching case set.

LPA-1, Power Booster Amplifier Kit $39.95
CLPA, Matching Case Set for LPA-1 Kit $14.95
LPA-1WT, Fully Wired LPA-1 with Case..... $99.95

Touch-Tone Reader

Read touch-tone numbers from any radio, phone line, tape recorder - any audio source! Decipher called numbers on scanners, radio shows, anywhere touch-tones are used. Memory stores up to 256 digits, an 8 digit display window scrolls anywhere in memory. Memory good for 100 years, even with power off! Runs on 7 to 15 volt DC, Available in kit form with optional matching case set or fully assembled in case set. We sell tons of these to private investigators!

TG-1, Tone-Grabber Touch Tone Reader Kit..... $99.95
CTG, Case for Tone-Grabber Touch Tone Reader $14.95
TG-1WT, Tone-Grabber, fully assembled with case $149.95
AC12-5, 12 Volt DC Wall Plug Adapter $9.95

Dinky Radios

Everyone who sees one of these babies says they just gotta have one! Super cute, tiny (that's a Quarter in the picture!) FM radios have automatic scan/search tuning, comfortable ear bud earphones and we even include the battery. The pager style unit looks like a shrunken pager and even has an LCD clock built-in. The crystal clear sound will amaze you! Makes a great gift.

MFMT-1, World's Smallest FM Radio..... $11.95
PFMR-1, Pager Style LCD Clock & FM Radio $12.95

Order Toll-free: 800-446-2295

Sorry, no tech info, or order status at 800 number

For Technical Info, Order Status Call Factory direct: 716-924-4560

RAMSEY ELECTRONICS, INC.
793 Canning Parkway Victor, NY 14564

See our complete catalog and order on-line with our secure server at:
www.ramseyelectronics.com

VISA MasterCard AMERICAN EXPRESS DISCOVER

ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add $6.95 for shipping, handling and insurance. Orders under $20, add $3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

HP 4800A Vector Z meter, $850; HP 5340A, 18GHz ctr opt 010, $1,200; HP 3581C level meter, $800; HP 8363B sig. gen. 2.3-6.5GHz, $1,500; HP 618C sig. gen., $400. A-Comm Electronics 303-341-2283.

FLUKE A90, $20; Fluke 893A, $20; Fluke 8050A DMM w/battery, $75; Fluke 5450A resistance calibrator, $1,500; Fluke 5440A voltage calibrator, $1,500; Hewlett Packard 3455A DMM, $200; Hewlett Packard 201C, $50; Tektronix TG501A, $175; Tektronix 7A26, $25; Tektronix 7A18, $25; Tektronix 7B53A, $25; Tektronix AM503 w/probe, $125; Tektronix T912A oscilloscope, $150. Miller Instrument, 219-726-3503.

TEKTRONIX 491 spectrum analyzer 10MHz-40GHz, $1,500. We ship. Lou 703-709-9543.

SOLDER EXTRACTORS: Pace MBT250 $950, **MBT220** $700, **MBT250 base only (PPS85)** $275 scratched, $400 nice; **Weller DS1000** $250. **Air powered: Weller DS100** $175, DS500 $150, **hot tweezers** $50, **SMD rework** $700. **Soldering stations**: **Weller WTCPN** $50, **EC2000** $100, **EC2001-ESD** $110, **EC2002M** $225 nu. **Rotary sponge** $25. More stuff, ask. Can refurbish cosmetically & electrically solder or desolder stations. Contact Jim Weller 310-515-2058.

AFFORDABLE HP power sensor repair! Most 8481As repaired for $255 or less. We also handle 478As and many others. Call or fax for more information. Willamette RF, Inc., 541-754-7226, FAX 541-753-4629.

FACTORY NEW, Firebird 2000 data error analyzer, complete with operating & remote control manuals, accessories covers etc., $250, 4 available. Hewlett Packard audio analyzer 8903A, $475; Tektronix 7904 w/7A26, 7A24, 7B80, 7B85 with manual, $565. 1142A probe control power module, $185, 4 available. Hitachi V422 o-scope, w/manual & probes, $250. Call for others. **Psitech Plus** 707-745-4804.

EQUIPMENT SALE: Hewlett Packard 1024MHz signal generator 8640B opt 002, 003, $1,050; HP 83592B, opt 002 .01-20GHz sweeper, $6,250; 18GHz spectrum analyzer, 141T, 8552B IF, 8555A RF, $825; Hewlett Packard 3336C synthesizer & level generator with options 004, 005, $700, plain $300; Wavetek 3001 signal generator, $275; Hewlett Packard 8015A opt 03, $250; 8015A, $200; HP 3403C opt 03 TRMS voltmeter, $200, 3403C, $150; HP 3763A error detector, $300. Offers accepted. Psitech Plus 707-745-4804, check our new www.psitech-plus.com

SECURITY

STOP THEM from listening in or recording your telephone conversations with the **TELEPRIVACY-PLUS**. Send $49 to Vakis, 1402 Pine Ave., Niagara Falls, NY 14301.

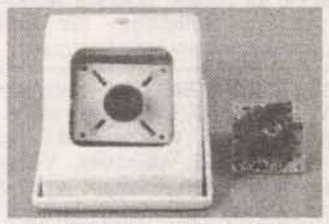
CONSUMERTRONICS 120+ exciting manuals: Electronics, computers, Internet, phones, energy, radionics, financial (including stocks), crime-fighting, security, survival, phenomena, **SPECIAL PROJECTS**. Catalog $3. PO Box 23097, Albuquerque, NM 87192. **www.tsc-global.com**

SURVEILLANCE-COUNTERSURVEILLANCE: I buy and sell used equipment. Steve 410-879-4035.

WIRELESS VIDEO audio Wavecom Jr., $95; Wavecom Sr., $140; Baby monitor, $180. Tel 1-800-600-4974, www.aljon tech.com

COUNTER-SURVEILLANCE=$250 HR! Electronic eavesdropping is unbelievably widespread! Are you sure you're safe? Learn how others (without prior experience) earn **$250 HR** in the fascinating field of COUNTER-SURVEILLANCE! For FREE catalog call: **1-800-732-5000.**

ALL NEW: THE COVERT CATALOG 2000. The MASTER LIST of information suppliers, specialized newsletters, OEM lock picks, reverse engineers, spy shops, alternate IDs, program crackers, and more. Locate impossible equipment, shop where the smart guys shop. Provides hundreds of addresses, sample pages, catalog prices and recommendations that will save you money on everything from break-in books to undetectable bugs. Catalog #COVCAT-2, price $34.95 + S&H $6 US, $7 CAN. NY state add $3.38 tax. Visa, MC, Discover, money orders. Mail: CRB, PO Box 56-NV, Commack, NY 11725. Phone: 516-543-9169.



WEATHERPROOF ENCLOSURE for board cameras, fits all 30-42mm color/back & white cameras, $59. Matco, Inc., Schaumburg, IL 1-800-719-9605 Fax: 630-350-9546. E-Mail: nsales@mat-co.com Web site www.mat-co.com

SEEKING DISTRIBUTORS FOR SECURITY PRODUCTS. Matco, Inc., Schaumburg, IL 630-350-0299. www.mat-co.com

Controlling The World With Your PC...

Here's a useful book that tells you how to connect your personal computer to the real world and make it do useful work like controlling stepping motors, monitoring fluid levels, or switching appliances on and off. No PC modification necessary for these projects either -- every circuit in this book connects directly to the parallel printer port of your PC! Also included are a circuit diagram and listings for control software written in Pascal, C, and BASIC. AND (this is the good part) the accompanying disk contains full source code in all languages plus compiled (.EXE) files -- (that means no typing ... yeah!) Whether you want to generate audio tones and speech, drive high power loads and DC relays, or convert DTMF tones to binary values, this book is a great source for information, projects, and ideas. There are also 9 appendices (that's plural for appendix - that hunk of helpful info that didn't fit into any one chapter of the book!) They cover such topics as expanding the parallel port for 24 bit I/O, bidirectional printer port use, and using your PC's game port for input. Controlling The World with Your PC is $35.00

RF DETECTION DISK
$15.00

Are you being bugged? Curious about the RF near your radios? Ever wonder how much wave you get from your microwave? This little unit illuminates into blinking mode when near any RF. Cell phones, PCS phones, cordless phones, hand held transceivers – they all activate the detection disk. (Don't worry, your unit in standby mode won't activate the disk – transmissions and incoming calls cause it to blink!) Compact RF disk can be worn on a neck chain, attached to your key ring, hung from your rear view mirror, or shoved in your pocket until you want to use it! Detects RF 1 Mhz to 2.5 Ghz, and is only activated at close range. Uses a CR-2032 battery – yes, it is included! (Light may be hard to see in bright areas.)

PHOTON II MICROLIGHT

The popular photon microlight has been improved. These super-bright (better than 8 candellas!) LED lights are visible over a mile away. The LED is secured in a tough ABS case and offers a squeeze button for quick use, and a constant on slide switch for prolonged lighting needs. The lithium batteries last a very long time (10 year shelf life!) and are included. The light won't burn out because it is an LED! Specify your choice of five incredible bright colors. Great for home or office use, popular with fire and rescue professionals, pyrotechnicians, stage performers, and dimly lit restaurant patrons. PHOTON II microlights include a keyring and come in ruby red ($13.50), amber yellow ($13.50) orange ($13.50), sapphire blue ($17.50), diamond white ($17.50), turquoise ($17.50), and emerald green ($17.50). Includes two replaceable 2016 lithium batteries.

TV TRANSMITTER KIT $27.95

Tired of lugging the VCR to another room to see a movie while Aunt Martha watches reruns of the Julia Child special on PBS? Sick of stringing wires through the house so Junior can watch the latest Power Ranger movie in the comfort of his room? Never fear, we've got the solution! This kit allows you to send any audio and video source, like a VCR or TV camera, to any TV set for up to 300 feet. With this little kit, you're the producer and the programming director of your own TV station. Tunable to any TV channel 2-6, runs on 12 VDC, and accepts standard audio and video signals. Optional matching case set, $14.95

Geophone
vibration sensing kit

Detect a fly stomping across the desk!
Well maybe not that sensitive, but almost. These vibration sensors made by Geosource® were used in oil exploration to determine geological statistics. They are made with a magnet suspended in a coil and are very sensitive to vibration.
Compact size, the unit measures approx. 1.6" high and 1.2" dia. The kit includes a geophone vibration sensor along with parts to build a basic detector that will light an LED. In addition we include a schematic that will show you how to operate a relay. The sensitivity is adjustable, so you can set it to detect elephants and other small creatures. Similar units were used by our armed forces to detect enemy troop movements...the perfect device to alert you to the pitter patter of little Leroy's feet! Unit sensitivity can be set high enough to detect a business card dropped on a table, and we've made it work with vibrations up to 40 feet away! Earthquake or Aunt Agatha...you decide! It's a fun gadget with many uses.
COMPLETE GEOSENSOR KIT....$ 9.95
GEOSENSOR UNIT ONLY....$7.95

AMAZING MINI MICRO FM RADIO!
$7.50

Much lighter than a heavy jam box with really good sound! This tiny radio (1.5"x1.06"x0.38") has a seek button, reset control, and an on/off switch.
Personal listening has never sounded better!
Ideal for ballgames, studyhall, and workouts.
Battery and nugget style earphones included.

Lighted Screwdriver Supertool! $9.95

At first glance, this appears to be an ordinary screwdriver, but press a button on the base and two lights illuminate the area you are working on. Nifty, huh? But wait, there's more! The seven interchangeable bits are stored right there at the base of the screwdriver (6 storage slots) for easy access. No handles to unscrew or tool boxes to dig through. Hey, you ain't seen nothin' yet...remove the bit and the magnetic retrieval tool telescopes from the screwdriver shaft! Incredible!!! Of course, the comfort grip handle and rugged construction are icing on the cake! Definitely a 'gotta have it' tool!

Passive Infra-red
Talking Motion Detector !!! $27.50

"Stay out of that refrigerator !", "Watch your step!", "Do your homework", "Don't touch that remote!" ... The possibilities are mind-boggling with this talking motion detector. You speak into it to record your message (upto 12 seconds long), turn the unit on, and instantly your voice (or your mother-in-laws) reminds anyone in the vicinity that you were expecting them. Message can be changed with the flip of a switch. Uses 4 AA batteries (not included), or an external power source (built-in jack). May be used independently (80 db output) or with an amplified speaker to blast your message throughout the house. Approx 4"x 3-1/2"x 1-1/2".

www.gatewayelex.com

gateway ELECTRONICS, INC

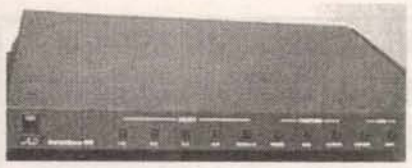
8123 PAGE BLVD * ST. LOUIS, MO 63130 * (314)427-6116
9222 CHESAPEAKE DR. * SAN DIEGO, CA 92123 * (619)279-6802
2525 FEDERAL BLVD. * DENVER, CO 80211 * (303)458-5444
MAIL ORDERS CALL TOLL-FREE 1-800-669-5810
FAX ORDERS (314)427-3147

THE FINE PRINT : PRICES SUBJECT TO CHANGE WITHOUT NOTICE * GATEWAY IS NOT RESPONSIBLE FOR PRINTING ERRORS * MASTERCARD, VISA AND DISCOVER ACCEPTED * YES, WE'LL TAKE YOUR CHECK -- SORRY, NO C.O.D.s * $10 MERCHANDISE MINIMUM ON MAIL ORDERS * SUPPLY OF SOME ITEMS IS LIMITED * PRICES DO NOT INCLUDE SHIPPING * UPS GROUND SHIPPING/HANDLING WITHIN THE CONTINENTAL U.S. (ITEMS REQUIRING ADDITIONAL AMOUNTS ARE NOTED)...$5.00 FOR THE FIRST ITEM, $0.50 FOR EACH ADDITIONAL ITEM. RESTOCKING CHARGE MAY BE ASSESSED ON RETURNED ITEMS. * JUST THINK HOW MUCH DEEPER THE OCEAN WOULD BE IF SPONGES DIDN'T LIVE THERE!

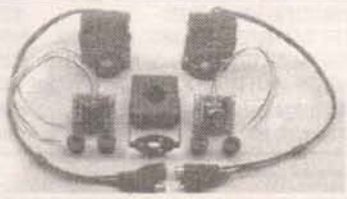
DISCOVER VISA

nv1099

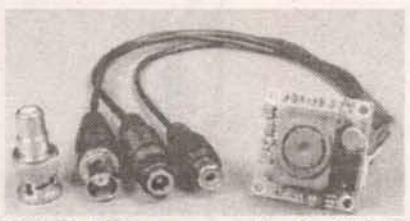
Write In 34 on Reader Service Card.



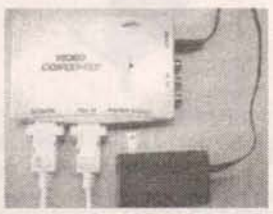
SECURITY CAMERA QUAD PROCESSOR: American Dynamic AD1476 real-time high-resolution B&W 2-page duo-quad. W/time + date generator, sequential switcher, titler, 2-video outs, full-screen playback. ADs top-of-the-line quad unit. A MUST for any home or business security camera sys. Industrial unit, not a toy. BNC ins + outs. This unit will take up to 8 cameras and display them in quad mode or full-screen. Dlr. cost **$575**. NOW **$225** w/1 yr. warranty, while supplies last. Also avail: AD1475A, **$175**; AD1474-4 cam quad, **$125**, and other multiplexers @ 40-60% off dlr. prices. Remember: Don't buy junk. Pro-Vid Systems, Woburn, MA. 781-933-0827. E-Mail: ricksvideo@msn.com



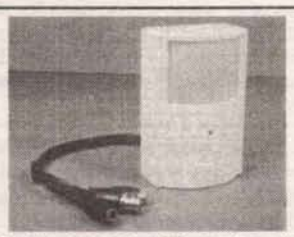
COLOR — LOW light CCD pin hole and standard lens available, only 1.27" x 1.27", $109. Sony sensor **with audio**. Matco, Inc., 1-800-719-9605 Fax: 630-350-9546. E-Mail: nsales@mat-co.com Web site www.mat-co.com



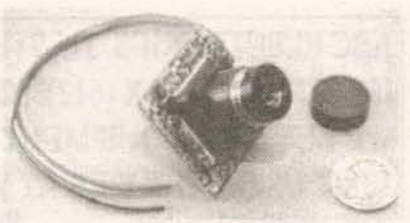
B/W BOARD camera w/audio, $49 @ qty 10, 1.27" x 1.27". Enclosure available for $10. Matco, Inc., 1-800-719-9605 Fax: 630-350-9546. E-Mail: nsales@mat-co.com Web site www.mat-co.com



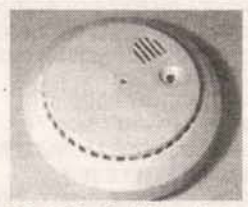
CONVERTS PC MONITOR to SECURITY MONITOR. The VGA-801 accepts standard NTSC or PAL inputs for display on any existing VGA/SVGA computer monitor. Small compact size, 4-1/2" x 2-1/2" x 3/4". Over 600 lines of resolution, twice that of standard TV monitor! High quality audio output feeds speakers directly. Excellent grey-scale conversion; works well with B/W inputs. Power supply included; **$69 each**. Dealers welcome. MATCO, Inc., 1-800-719-9605; Fax 847-619-0852; E-Mail: sales@mat-co.com Website: www.mat-co.com



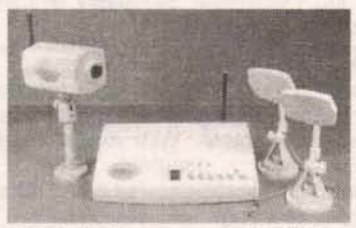
SPECIAL! IC 113: PIR motion detector with audio! W/ NO/NC alarm output. CCD camera with audio can be turned on by detector. 5-1/4" (L) x 2-3/4" (W) x 2" (D). **$89** @ 5 pcs., $82 @ 10 pcs. Matco, Inc. 1-800-719-9605 Fax: 630-350-9546. E-Mail: nsales@mat-co.com Web site www.mat-co.com



B/W 430 LINE CCD CAMERA with optional black low-profile swivel adjustable enclosure. Pin hole or Std. lens type. 6, 8, and 12mm lens are available. 1/3" CCD, 3.6mm/F2.0 lens included; 9-14 VDC, 0.08 lux, IR sensitive; 1.27" x 1.27" x 0.5"D pinhole or 1" deep standard. Price @ 10 pcs., **$44 each**. Enclosure: $8; optional lens: $18. Dealers welcome. MATCO, Inc. 1-800-719-9605. Fax 847-619-0852. E-Mail: sales@mat-co.com Website: www.mat-co.com



SALE! PS 102: Built-in pin hole CCD, lens size: 3.6mm. 5-1/2" (D) x 1.7" (H). **$79 @ 5 pcs.**, $72 @ 10 pcs. Distributors welcome. Matco, Inc., 1-800-719-9605 Fax: 630-350-9546. E-Mail: nsales@mat-co.com Web site www.mat-co.com



AS-1004, FCC approved. 2.4GHz transmitter & receiver with audio! Capable handling total of 4 wireless cameras, range: >300'. Built-in camera, 400 TV line. **$189 a pair** @ 5 pcs., $179 @ 10 pcs. Additional camera $119 @ 10 pcs. Matco, Inc. 1-800-719-9605 Fax: 630-350-9546. E-Mail: nsales@mat-co.com Web site www.mat-co.com

HUGE EQUIPMENT SALE!!!

AMPLIFIER RESEARCH 5W1000 - 5 watt/1GHz Amplifier $750
BIDDLE RM 215-L2 - AC/DC Bkdn Leakage/Ionization Tester $600
BK PRECISION 1730 - DC Power Supply Adj. 30 VDC/3A (New) $175
(2) BK PRECISION 3011B - Function Generator . . . . . $160 ea.
CAMBRIDGE 510A - Micro-Ohmmeter . . . $825
EIP 351D - Frequency Counter (20Hz-18GHz) $875
FLUKE 9010A - MicroTroubleshooter w/acc., probe, IC Mounts $1150
GARNER INDUSTRIES 682C - Degauser $2450
HP 180 - Oscilloscope w/1801A and 1821 Modules $200
HP 3314A - Function Generator, NEW . . $1650
HP 4342A - Q-Meter Component Tester . $1000
HP 5182A - Waveform Recorder/Generator $9500
HP 5335A - Freq. Counter (0-1300MHz) w/Opt. 030, 040 . . . . . $1250
HP 8012B - Pulse Generator $450
(3) HP 8111A - Function Generator . . . $300 ea.
HP 8405A - Vector Voltmeter $1200
HP 8620C - Sweep Oscillator Mainframe w/Option 011 - HPIB $550
HP 86222B - Sweep Oscillator (.01-2.4GHz) $1150
HP 86290B - RF Plug In (2-18.2GHz) . . $1350
HP 8901B - Mod. Analyzer w/Opt. 001 (150KHz-1300MHz) $1750
HP 8903B - Audio Analyzer (20Hz-100KHz) Opt. 001, 011, 013 . . . . . $1500
HP 8970A - Noise Figure Meter $3300
IFR F1200SR - Spectrum Analyzer Scanning Receiver (100KHz-1GHz) $3450
LEADER LDC 824S - Frequency Counter 520MHz $250
ROHDE & SCHWARZ MSC-2 - Stereo Coder $750
(2) SAMPLEX M-PSA 505 - DC Power Supply Adj. 50 VDC/5A - NEW . . . . . $175 ea.
SCIENTIFIC ATLANTA 6460R - Laser Transmitter $1450
SCIENTIFIC ATLANTA 6460 - 750MHz . $1450
SENCORE VA-48 - Video Analyzer $275
TEKTRONIX AA 5001 - Programmable Distortion Analyzer $1750
TEKTRONIX AM 511 - CATV Pre-Amp . . . $525
TEKTRONIX SG 5010 - Programmable Oscillator $1950
TEKTRONIX TM 5006 - 6 Wide Mainframe $550
TEKTRONIX TM 504 - 4 Wide Mainframe . $200
TEKTRONIX 1405 NTSC - TV Sideband Adapter $4500
TEKTRONIX 141 - PAL Video Generator . . $875
TEKTRONIX 1411 - PAL Video Generator w/Option 04 . . . . . $950
TEKTRONIX 1430 - Noise Test Set $450
TEKTRONIX 146 - NTSC Video Generator $875
TEKTRONIX 147 - NTSC Video Generator $875
TEKTRONIX 147R - NTSC Video Generator $975
TEKTRONIX 1470 - NTSC Video Generator $300
TEKTRONIX 1480R - Waveform Monitor . . $975
TEKTRONIX 1480C - Waveform Monitor . . $975
TEKTRONIX 1485R - Waveform Monitor . $1275
(2) TEKTRONIX 520A - Vectorscope $975
TEKTRONIX 528 - Waveform Monitor $600
TEKTRONIX 528A - Waveform Monitor . . . $800
TOSHIBA SD120 - Variac 14 Amp (0-130 VAC) $125
WAVETEK 2102 - Oscillator (5MHz) $150

EQUIPMENT WANTED

Alcoa Fujikura FSM-30S F.S.
Comsonics Win. Lt. Plus S.L.M.
HP/Calan 3010R Swp. Rcvr.
HP/Calan 3010H Swp. Trans.
HP 3458A DMM
HP 85032E Cal Kit
HP 85039B Cal Kit
HP 8591C Spec. Analyzer
HP 8591E/001 Spec. Analyzer
HP 8647A/1ES Sig. Gen.
HP 8711C/1EC Network Analyzer
HP 8713B/1EC Network Analyzer
HP 8753D/075 Network Analyzer
L.P. TD 1000 OTDR
Siecor M-90 Fus. Spl.
Sumitomo Type 35SE, Fus. Spl.
TEK 1780R WFM
TEK 2714 Spec. Analyzer
TEK 2715 Spec. Analyzer
TEK RFM 150 SLM
TEK RFM 151 SLM
TEK TFS 3030/06 OTDR
TEK TFS 3031 OTDR
TEK TV 1350 Prec. Demod.
Wavetek 1175 Benchmark
Wavetek 3SR Swp. Receiver
Wavetek 3ST Swp. Trans.
Wavetek CL1 1450 SLM
Wavetek MS 1200 SLM
Wavetek MS 1000 SLM
Wavetek SAM 4040 SLM

CONTACT INFO

PTL Test Equipment, Inc.
612 N. Orange Ave., Suite D-8
Jupiter, FL 33458

PHONE: (561) 747-3647
EMAIL: PTLTE@aol.com
FAX: (561) 575-4635
WEB: www.PTLTEST.com

Write in 35 on Reader Service Card.

ELECTRONIX EXPRESS

WELLER SOLDERING STATION – *MODEL WLC 100*
- Variable power control (5 to 40 watts)
- Replaceable heating element
- Quality light-weight pencil iron

$36.95

LOWEST PRICE 20MHZ SCOPE!
INSTEK OSCILLOSCOPE 20MHZ DUAL CHANNEL *MODEL GOS-620* $299.00

SCOPE PROBE 60 MHZ *SWITCHABLE X1, X10* $12.95

DIGITAL MULTIMETER *WITH CAP/FREQUENCY/ TRANSISTOR TESTER* Model DM645 $34.95

INSTEK FUNCTION GEN. WITH INT/EXT FREQ. COUNTER *MODEL 8016* $199.00

ALLIGATOR LEADS *SET OF 10* $2.10

SWITCHES
8 POS DIP ..... 60¢ ea.
Mini Toggle SPDT ..... 50¢ ea.
ON-ON

PAD-234 DIGITAL/ANALOG TRAINER
Complete portable workstation. Variable and fixed power supplies, function generator, digital I/O, rugged design, high impact case.
Assembled $150.00 Kit $110.00

HIGH QUALITY TOOLS *With Cushion Grips and Return Spring*
Needle Nose Pliers $2.95 | Wire Stripper $1.50 | Diagonal Cutter $2.95

POWER SUPPLIES
0–30 VDC, 0–3 Amp. Built-in current limiting, overload protected, constant voltage and current operation.
01PSGP4303A Analog Display $165.00
01PSGP4303D Digital Display 189.00

RSR — TELECOMMUNICATIONS TRAINER
HANDS-ON TELEPHONY, LAN, CATV EXPERIENCE WITH ONE SELF-CONTAINED UNIT
T-Comm Trainer (TCM-100) $199.95
Lab Manual / Work Book 19.95
Component and Supplies Kit 39.95
Tool Kit 119.95
Only $199.95 *MODEL TCM-100*

SOLDERLESS BREADBOARD
830 tie points. MB102PLT model features 3 binding posts and aluminum backplate.

Part No.	1-9	10+
MB102	5.95	5.00
MB102PLT	8.95	8.00

HELPING HAND WITH MAGNIFIER $3.50 #060836

RESISTOR KIT 1/4W 5% film. 5 pieces each of 73 values. 365 pieces total. $3.95

MOTION DETECTOR $2 ea. – 10 For $15

SOLDERING IRON 3-WIRE *HIGH PERFORMANCE* #060501 $5.25

LM555	10 Min.	22¢ ea.
LM741	10 Min.	27¢ ea.
74LS00	10 Min.	18¢ ea.
7805 Regulator	10 Min.	30¢ ea.
2N3904	10 Min.	6¢ ea.
PN2222	10 Min.	6¢ ea.
Red LED T 1¾	10 Min.	6¢ ea.
Green LED T 1¾	10 Min.	7¢ ea.
Yellow LED T 1¾	10 Min.	8¢ ea.
Photo Cell	10 Min.	65¢ ea.
100K Pot., 1" Shaft PC Mt.	10 Min.	15¢ ea.

FREE CATALOG
MORE Low-Priced Items In Our FREE 236-Page Catalog

TERMS: Min. $20 + shipping. School Purchase Orders, VISA/ MC, Money Order, Prepaid. NO PERSONAL CHECKS, NO COD. NJ Residents: Add 6% Sales Tax.

In NJ: 732-381-8020
FAX: 732-381-1572
365 Blair Road • Avenel, NJ 07001-2293
800-972-2225
http://www.elexp.com
email: electron@elexp.com

Write in 36 on Reader Service Card.

INTERNET SECURITY

The latest tricks and methods hackers use on the Net to pirate software (warez), and hack websites. Includes examples, countermeasures, password defeats, Packet-Switched Networks, UNIX, Sprintnet, X.25, anonymous FTP, brute force techs, lots of tips. *More!* $29. wrds=29.4K

INTERNET TRACKING & TRACING: Scammers, spammers, stalkers, infectors, and others hide behind the Internet's anonymity to commit serious offenses. Learn from master hackers best methods to track, trace IDs and origins, and to protect your own privacy. *More!* $29. wrds=17.0K

INTERNET FRAUDS DATABOOK: Internet cons, scams and related frauds now rake in $2+Billion annually! Most are done anonymously with impunity. Details how they're done, how to ID them, how to protect yourself. *More!* $25. wrds=19.1K

COOKIE TERMINATOR! $25. wrds=8.4K

Any 2 for $49, 3 for $64

ATM SECURITY

100+ ATM crimes, abuses, vulnerabilities, defeats exposed - TEMPEST, mag stripes, false fronts, supercool, *More!* Case histories, labeled internal photos, figures. $39. wrds=41.0K

PBX SECURITY

PBXs hacking losses of $5-$10 Billion/yr! Detailed vulnerabilities (especially for out-dial), countermeasures. Exclusive author interview in Forbes! $24. wrds=17.4K

CELLPHONE/CORDLESS GUIDE

How cellphones operate; mods. Vulnerabilities to hack attack; countermeasures. Cloning details for NAMs, ESNs, etc, control data formats, computing encoded MINs, ESNs, SIDHs, Op Sys, PROMs, forcing ACK, test mode and resets, cable diagrams, scanning, tracking, scanner restorations, freq allocations, roaming, step-by-step to keypad-reprogram 100+ popular cellphones. One FREE database search. Plus much on Cordless phones. *More!* $49. wrds=80.0K

PAGER (BEEPER) MANUAL: How Pagers work, different types and uses, freqs, advantages over and uses with cellphones, and tips and tricks. How phreaks hack Pagers; countermeasures. Plus plans for a Personal Pocket Paging System (xmitter and receiver). *More!* $29. wrds=11.7K Both for only $69

THE DIRTY-2 DOZEN!

24+ *Hot* Hack/Phreak Expose' Disks!

See Web CATALOG NOW!

COMPUTER SECURITY

Describes in detail how computers penetrate each other, and how VIRUSES, TROJAN HORSES, WORMS are implemented. Dozens of computer crime and abuse methods and countermeasures. Includes disk filled with hacker text files and utilities, and the legendary FLUSHOT+ protection system. Internet advice, password defeats, glossary - *much more!* Manual + PC Disk! $39. wrds=49.5K

THE HACKER FILES: Expose' 3 HD PC disks filled with choice raw, colorful, highly informative hacker, phreaker text files covering many topics! $39.

Both for only $69

BEYOND VAN ECK TEMPEST

Remote eavesdropping plans of TV video "noise" signals. Range up to 1 KM. Describes how van Eck systems work, and are also used in surveillance of computer systems. Plus TVRO vs phone privacy detailed! $29. wrds =14.9K. Van Eck Demo Tape is $29. (15 min). Both for only $49!

CALLER ID & ANI SECURITY

How they work and the many vulnerabilities of Caller ID, ANI, *69, *57, Call Blocking, *67, et al. Describes ESS, SS7, CN/A, CAMA, DNR, Diverters, Centrex! $25. wrds=15.2K

FAX MACHINE SECURITY

All known methods used to hack Faxes and countermeasures. Includes computer fax modems, crimes, interceptions, fax servers, fax-on-demand, protocols, parameters, compression, encryption, and fax surveillance-type mods. *More!* $29. wrds=29.0K

POWER METER SECRETS

As reported on "60 MINUTES"! 6th Edition! Details devices that can slow down (even stop) power meters while loads draw full power - great science projects! Devices plug into one outlet and normal loads into other outlets. Describes meter creep, overload droop, pole meters, etc. $29. wrds=10.4K

SPM THE VIDEO: Now its easier to learn about KW-HR Power Meters than ever before! This educational video shows you how they work and their anatomy. Demonstrates SPMEM device and external magnetic methods used to slow and stop meters! Hosted by a top expert in the field. From the novice to the pro, an excellent source of info on these exciting devices! Great in combo with our SPM-related manuals! $29. (20 min)

THE I.G. MANUAL: Details external magnetic ways (applied to meters) outlaws use to slow down and stop power meters while drawing full loads. $25. wrds=4.9K

KW-HR METERS: How watt-hour energy meters work, calibration, error modes (many), ANSI Standards, etc. Demand and Polyphase Meters. Experimental results to slow, stop power meters by others. $25. wrds=24.2K

Any 2 for $49, 3 for $64, all 4 for $79

VOICE MAIL SECURITY

VMSs are hacked to penetrate PBXs to make outgoing calls, get free VMB usage, secretly read/change/delete messages, control/damage the VMS (or its PBX) itself. Details how they do it, countermeasures. A must for users, sysops, security personnel! $29. wrds=14.2K

MANY MORE TITLES!

(See Catalog for prices & descriptions)

POWERFUL STOCK SOFTWARE
BEYOND PHONE COLOR BOXES
ANSWER. MACHINE SECURITY
CASINO SECRETS
CHECK & M.O. SECURITY
CREDIT CARD SECURITY
CONS & SCAMS DATABOOK
SOCIAL ENGINEERING
POLYGRAPH SECRETS
BY AN ORDER OF THE MAGNITUDE
ULTIMATE SUCCESS MANUAL
STEALTH TECHNOLOGY
SIMPLE/CHEAP SECURITY ELEC.
SECRET & SURVIVAL RADIO
THE "GOLDFINGER"
THE "SILKWOOD"
SECRETS OF SOLDERLESS BBs
HIGH VOLTAGE DEVICES
MIND CONTROL
UNDER ATTACK!
RADIONICS MANUAL
HEAL THYSELF!
SECRET & ALTERNATE IDs
CRYPTANALYSIS TECHNIQUES
GOVERNMENT LAND GRAB
ROCKET'S RED GLARE
VORTEX GENERATOR
SURVIVAL GUNS & AMMO
THE ULTIMATE DRIVER

Plus Many More - Order Today!

TOP SECRET

CONSUMERTRONICS CATALOG $1 WITH ORDER, $3 W/O

2430 Juan Tabo, NE, #259, ABQ, NM 87112
P.O. Box 23097 ABQ, NM 87192
Fax: 505-292-4078 (all hours, orders only) Voice: 505-237-2073 (9-7 M-S)

FREE FULL WEB CATALOG: www.tsc-global.com

SPECIAL PROJECTS

We will design & build YOU just about anything electronic! All hardware done as SPECIAL PROJECTS. Send #10 SASE for SP Application Form, else get at: .../spaf-spp.html

Established in 1971 by John Williams, MSEE, former DOD weapons engineer and NIH physicist. Featured on CBS '60 Minutes,' Forbes, New York Times. Add $5 total S/H (US, Canada). Postal MO is fastest! VISA, MC OK. No CODs. 10% OFF all Orders over $100; $2.00 OFF all New Orders over $20 placed by Mail or Fax. wrds=Estimated Word Count

Sold for legal educational purposes only. Some publications are controversial! We take no responsibility for anything we publish. See Catalog for WARRANTY, SPECIAL PROJECTS and all other applicable policies.

ABC ELECTRONICS 315 7TH AVE N. MPLS. MN. 55401
(612)332-2378 FAX (612)332-8481 E-MAILSURP1@VISI.COM
WE BUY TEST EQUIPMENT AND COMPONENTS.
VISIT US ON THE WEB AT WWW.ABCTEST.COM

HP 54501A 100MHZ DIGITIZING SCOPE	$1300.00	HP 4935A TRANS.IMPAIRMENT TEST SET	$900.00
HP 54201D 300MHZ DIGITIZING SCOPE	$1000.00	HP 5006A SIGNITURE ANALYZER	$150.00
HP 54201A 300MHZ DIGITIZING SCOPE	$1000.00	HP 86602B 1MHZ-1300MHZ RF PLUG	$400.00
HP 54200A 50MHZ SCOPE/WAVEFORM ANALYZER	$700.00	EIP 575 MICROWAVE COUNTER	$1500.00
HP 3312A 13MHZ FUNCTION GENERATOR	$250.00	FLUKE 95 50MHZ SCOPEMETER	$$50.00
HP 5370A 100MHZ U.T.I. COUNTER	$400.00	LECROY 7200 400MHZ O-SCOPE	$1000.00
HP 3586C LEVEL METER	$750.00	TEK 475 200MHZ O-SCOPE	$500.00
HP 436A POWER METER W/O SENSOR&CABLE	$500.00	TEK 465 100MHZ O-SCOPE	$400.00
HP 8350B SWEEP OSCILLATOR MAINFRAME	$2000.00	TEK 496P 1KHZ-1.8GHZ SPEC ANALYZER	$3500.00
HP 3437A 3.5DIGIT SYSTEM VOLT METER	$250.00	TEK 1240 LOGIC ANALYZER	$750.00
HP 3455A DIGITAL MULTIMETER	$250.00	TEK TDS320 100MHZ DIGITAL O-SCOPE	$1400.00
HP 3456A DIGITAL MULTIMETER	$400.00	TEK 11401A 500MHZ PROG.O-SCOPE FRAME	$750.00
HP 3336C SYNTHESIZER/LEVEL GENERATOR	$800.00	TEK 7854 400MHZ OSCILLOSCOPE FRAME	$500.00
HP 3325A SYNTHESIZER/FUNCTION GENERATOR	$1000.00	TEK 7904 400MHZ OSCILLOSCOPE FRAME	$250.00
HP 5335A 200MHZ COUNTER	$600.00	TEK 7A26 200MHZ VERTICAL PLUG	$75.00
HP 8165A PROGRAMMABLE SIGNAL SOURCE	$1100.00	TEK 7A24 400MHZ VERTICAL PLUG	$150.00
HP 8558B/181 100K-1500MHZ SPECTRUM ANALYZER	$1000.00	TEK 7B80 400MHZ TIME BASE	$75.00
HP 8559B/183 10MHZ-21GHZ SPECTRUM ANALYZER	$3000.00	TEK 7B92A 500MHZ DUAL TIME BASE	$125.00
HP 1740A 100MHZ OSCILLOSCOPE	$250.00	TEK 7S12 SAMPLING PLUG	$250.00
HP 6034A 60VDC-10A POWER SUPPLY	$750.00	TEK 7L14 10KHZ-1.8GHZ SPEC. ANALYZER	$1000.00
HP 6269B 40VDC-50A POWER SUPPLY	$800.00	TEK AM503 CURRENT PROBE AMPLIFER	$250.00
HP 6553A 40VDC-12.5A. POWER SUPPLY OPT.J01	$1200.00	WAVETEK 145 20MHZ PULSE/FUNCTION GEN.	$400.00
HP 6632A 20VDC-5A POWER SUPPLY	$500.00	WAVETEK 182A 4MHZ FUNCTION GEN.	$150.00
HP 6643A 45VDC-4.3A POWER SUPPLY OPT.J03	$750.00	WAVETEK 955 7.5-12.4GHZ MICROSOURCE	$1100.00

Write in 38 on Reader Service Card.

HIDDEN VIDEO SURVEILLANCE CAMERAS. Factory direct, quality products & low prices. We design and manufacture our products. Free catalog, fax request to: MJ Electronics, phone/fax 914-699-2294. Call anytime.

SPY FILES or Encyclopedia of Investigation CD-ROMs, each contains thousands of pages of fascinating and useful documents. With Adobe reader, $32 each postpaid. Info at www.davidvineassociates.com Credit card orders only call 1-800-987-8743.

SATELLITE EQUIPMENT

SATELLITE EQUIPMENT available: Receivers $25 and up; 20-25 LNB $30; C-KU feed horns $65. Call 757-599-4408.

FREE FLYER on DBS files, hacking, hardware info. Smart card socket $5 ea. New Atmel 89C52 $10 ea. Bill 1-800-879-9657.

FREE BIG dish catalog. Low prices! Systems, upgrades, parts, and "4DTV." Skyvision, 1010 Frontier Dr., Fergus Falls, MN 56537. www.skyvision.com **Call 1-800-543-3025.**

BEST PRICING on 18" satellite TV systems for home and RV. DISH Network DirecTV, multi-room viewing options, accessories, more. www.skyvision.com **Call 1-800-543-3025.**

SATELLITE RADIO BOOK AND GUIDE. New book covers all Audio Services, SCPC, Subcarriers, FM Squared, Facsimile, Press Services, Weather Services. Simple how-to-receive instructions. $16.95 plus $3 Priority Mail. UNIVERSAL ELECTRONICS, 4555 GROVES ROAD, #12, COLUMBUS, OH 43232. 614-866-4605.

THE BEST is back to stay. Master code recovery. 16c5x, 16c62x, PALS, GALS, other microcontrollers, etc. Check out our web page at www.acdinc.com for details or call 703-764-5361 or write Advanced Circuit Designs, Inc., 5765-F Burke Centre Parkway, Suite 317, Burke, VA 22015.

FREE SATELLITE TV SYSTEM! Now is the time to get a small dish. Call 626-568-0903 and give certificate number 0141002. www.iwantadish.com

EXPLORE KU-BAND! Channel Master satellite systems from .75M to 1.5M with mount and LNB. New and used available. System prices starting at $50 complete. Perfect for DIRECPC, digital free-to-air, DTN, or 4dTV add-on. Call toll-free 1-888-728-1974, fax 316-649-2745, or E-Mail: **rives@pld.com**

ALFA ELECTRONICS

HIGH QUALITY TEST EQUIPMENT

Visit www.alfaelectronics.com for complete info

Call 1-800-526-2532 for Order and Free Catalog

DMM

DMM-89S ($179.00): true rms, AC/DC (V,A), Ω, bar graph, freq, capac., dBm, logic, diode
DMM-23T ($99.95): 4½ digit, true rms, high resol. (10µV, 10nA, 10mΩ), hFE, diode, contin.
DMM-20 ($74.95): AC/DC (V, A), Freq, cont., Capac, Induct., Ω, hFE, diode, duty cycle
DMM-122 ($59.95): DC/AC(V,A), Ω, hFE, diode, capacitance, freq, logic, continuity
DMM-123 ($44.95): DMM + capacitance, DC/AC(V,A), Ω, hFE, diode, continuity
DMM-10 ($19.95): 3½ digit, DC/AC V, Ω, hFE, diode, signal output(+3V,-0.5Vsq.,50%duty)

LCR /COUNTER

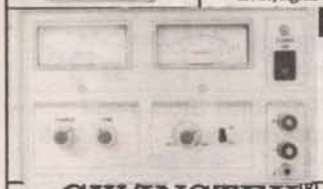
CAP-15 (*$49.95*): 3½ digit, 0.1pF-20mF, 9 Ranges, 0.1pF resolution, zero adjustment.
LCR-24 (*$119.95*): 0.1µH-200H, 0.1pF-2000µF, 0.01Ω-20MΩ, diode test. ***New Model.***
LCR-131D (*$219.95*): autorange, 0.1µH-10kH, 0.1pF-10mF, 1mΩ-10MΩ, Q Factor, serial/parallel, 120Hz/1kHz testing mode.
FC-1200 (*$129.95*): 1.25GHz counter. Handheld, 8 digits display, 10ppm accuracy, sensitivity 5mV (130-350MHz), 30mV (440MHz)

FLUKE

12B	$ 94.95
70-III	$ 99.00
73-III	$125.00
75-III	$155.00
77-III	$173.00
79-III	$195.00
87-III	$325.00
92B-III	$1,445
96B-II	$1,695
99B-III	$2,095
105B	$2,495
123-III	$1,130
863E	$555
867B	$740

SPECIALTY

• AC Current Probe	$34.95
• DC/AC Current Probe	$79.95
• Mini AC Clamp	$59.95
• AC Clamp w/temp	$89.95
• DC/AC Clamp	$109.95
• Thermometer	$69.95-$89.95
• IR Thermometer	$189.95
• Sound Level Meter	$169.95
• Tachometer	$169.95-$219.95
• EMF Tester	$69.95
• Pressure Meter	$299.95
• Watt Meter	$129.95
• High Voltage Probe	$59.95
• pH Meter	$79.95
• Light Meter	$79.95-$89.95



Single Output DC Power Supplies

- Constant current, constant voltage mode
- Short Circuit and overload protected

Analog Meters Display	*Digital Volt, Analog Current*
PS-303 ($159.00) 30V/3A	PS-8200 ($179.95) 30V/3A
PS-305 ($219.95) 30V/5A	PS-8201 ($239.95) 30V/5A
PS-8112 ($399.95) 60V/5A	*Digital Volt & Current Display*
PS-1610 ($289.00) 16V/10A	PS-8300 ($199.95) 30V/3A
PS-8107 ($399.95) 30V/10A	PS-8301 ($259.95) 30V/5A

Triple Output

- Independence or Tracking operation
- Parallel to double current output (PS-8102 & PS-8103 only)

Triple Output (Analog displays)
PS-8102 ($399.95) 30V/3A/30V/3A
PS-8103 ($489.95) 30V/5A/30V/5A
Digital Displays
PS-8202 ($499.95) 30V/3A/30V/3A
PS-8203 ($549.95) 30V/5A/30V/5A

AUDIO/RF/FUNCT. GEN.

RF Generator • SG-4160 ($124.95) 100kHz-150MHz sinewaves in 8 ranges
• SG-4162AD($229.95) with 6 digit counter
Audio Generator • AG-2601 ($124.95) 10Hz-1MHz, 0-8Vpp sine, 0-10Vpp squarewave
• AG-2603AD ($229.95) with 6 digit counter
Function Generator • FG-2100A ($154.95) 0.2Hz-2MHz,5mV-20V_{pp}
• FG-2103 ($329.95) *Sweep* 0.5Hz-5MHz

GW/INSTEK®

DC POWER SUPPLIES

20 MHz Scope	100MHz Cursor	Triple Output	Single Output	Programmable	FUNCTION GENERATOR	BENCHTOP DMM
• **OS-620 $304.95** • Most economical scope • Dual CH/X-Y operation • 1 mV/div sensitivity • Z-axis input,CH1 output • TV syn, ALT trigger • 2 probes (x1, x10)	• **OS-6103 $1199.95** • **Cursor Readout & meas** • Dual CH / Delay sweep • 10 panel setting memory • Time base auto-range • Z-axis modulation input • 2 probes (x1, x10)	• 2 variable out 0-30V,0-3A • One fixed 5V,3A output • Auto track, serial, parallel • Const. volt, current mode • 4 analog or 2 digital display **PC-3030** ($499.95) PC-3030D ($549.95) digital	• Const voltage, current mod • Voltage regulation ≤0.01% • Current regulation ≤0.2% **PS-1830** ($198.95) 18V/3A **PS-1850** ($214.95) 18V/5A **PS-1830D**($214.95)18V/3A **PS-1850D**($244.95)18V/5A	• Auto serial/parall.(PPT ser) • Auto track (PPT series), IEEE-488.2 and SCPI compatible command set **PPS-1860G**($1,149.95)18V/6A **PPS-3635G**($1,149.95)36V/3.5A **PPT-1830G**($1,499.95)18V/3A **PPT-3615G**($1,499.95)36V1.5A	**FG-8015G** ($157.95) • 0.02Hz-2MHz • Sine/Squ/Tri/Pulse/Ramp **FG-8020G** ($209.95) • 0.02Hz-2MHz w/counter **FG-8050** ($449.95) Sweep • 0.05Hz-5MHz w/counter • INT/EXT AM/FM mod	**DM-8034**($179.95) 3½ dgt • AC/DV(V,A),C,Ω,diode **DM-8040**($339.95) 3¾ dgt • ACV to 50kHz, true rms **DM-8055G**($889.95)5½dgt • 0.006% accuracy, GPIB • dBm,auto,REL, min/max

ALFA ELECTRONICS
P.O. BOX 8089
PRINCETON, NJ 08543-8089

TEL: (800)526-2532 / (609) 897-1135
FAX: 609-897-0206
E-mail: sales@alfaelectronics.com

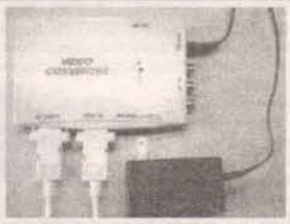
Call / Write / Fax / Email for FREE CATALOG
Visa, MC, AMEX, COD, PO Accepted. OEM Welcome.
1 Year Warranty (2 Years for GW/Instek)

Write in 37 on Reader Service Card.

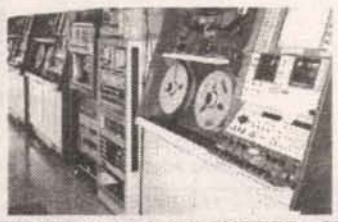
CABLE TV. Join us on the **INTERNET** to buy and sell cable TV equipment, electronic equipment, DSS equipment, satellite equipment, telephony equipment, and much more. Major equipment dealers and wholesalers online. Auctions, classified ads, discussion forums, chat rooms, and dealer links for all types of equipment. Dealers and vendors call or visit our site for ad rates and links. **WWW.GOCABLETV.COM** or call **1-800-451-0083.**

MILITARY SURPLUS ELECTRONICS

AUDIO – VIDEO – LASERS



CONVERTS PC MONITOR to SECURITY MONITOR. The VGA-801 accepts standard NTSC or PAL inputs for display on any existing VGA/SVGA computer monitor. Small compact size, 4-1/2" x 2-1/2" x 3/4". Over 600 lines of resolution, twice that of standard TV monitor! High quality audio output feeds speakers directly. Excellent grey-scale conversion; works well with B/W inputs. Power supply included; **$69 each.** Dealers welcome. MATCO, Inc., 1-800-719-9605; Fax 847-619-0852; E-Mail: sales@mat-co.com Website: www.mat-co.com



ANTIQUE VIDEO TRANSFER SERVICE: transfer any 2" QUADRUPLEX tape. Affordable fast! Phone/fax 415-821-7500 or 415-821-3359. 5001 Diamond Heights Blvd., San Francisco, CA 94131-1621.

WANTED: PRO video equipment, VCRs, switchers, cameras, etc. Advanced Media 702-874-1911.

ATV 2.2GHz to 2.7GHz wireless video data link module tuner & transmitter 100mW. Picotronic, web: http://members.aol.com/picotronic/atv.htm

BROADCAST VIDEO equipment wanted: all types, new or old. Please call, Jon with info. 1-800-539-2859.

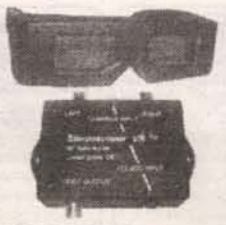
SYNC-A-LINKS's 3-D Scopers™ digital color CCD cameras for stereoscopic imagery. At a reasonable cost. Phone 918-479-6451, E-Mail: rlc@sstelco.com or write to **Sync-A-Link,** PO Box 4, Locust Grove, OK 74352.

SONY PLAYSTATION MODCHIPS. Allows playing of CDR backups & imports. $10 + $3 shipping. 619-590-9320.

FREE LASER CATALOG. Helium-Neon, Argon, ruby, visible laser diode modules, lightshows, holography, laser pointers. Lowest prices. Midwest Laser Products, PO Box 262, Frankfort, IL 60423. 815-464-0085 **www.midwest-laser.com**

VIDEO PROJECTORS: GE Tularia up to 2,000 watt. Projects to 20' wide screen, will accept smaller lamps. With spare parts and lens, $5,000 ea. or best, 3 available. 760-736-4411.

SYNC-A-LINK UNIVERSAL video sync generators. For more details phone 918-479-6451, E-Mail: rlc@sstelco.com or write to **Sync-A-Link,** PO Box 4, Locust Grove, OK 74352.



STEREOSCOPER VR is a stereo multiplexer that creates 3D stereoscopic video from two genlock cameras. Stereoscoper VR comes with LCS glasses and driver. 90 day warranty $247 or write to **Sync-A-Link,** PO Box 4, Locust Grove, OK 74352. Phone 918-479-6451, E-Mail: rlc@sstelco.com

CABLE TV

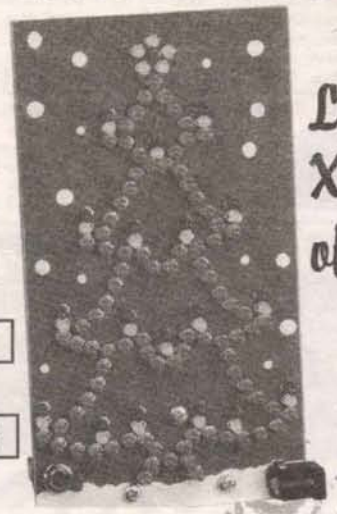
ATTN. DEALERS: Are you a current dealer or just getting started? Buy factory direct & save. New 125 channel volume control converter, 800MHz tuner. Also available non-volume converters. Call for lot pricing. A & S Wholesale, 1-800-370-0801.

GENUINE UNMODIFIED JERROLD DPBB 7312. 410-485-7772. E-MAIL: CLEWIS7298@AOL.COM

Continued on page 55

Electronics made easy **velleman** kits

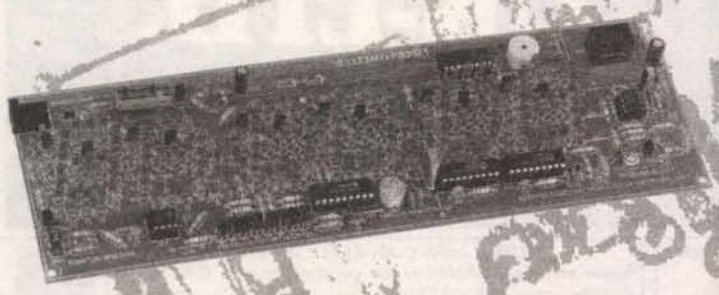
IT'S THE SEASON



Let one of our lighted Xmas trees remind you of this special time.

MK117 $19,95
MMK117 $24,95

MK100 $9,95
MMK100 $12,95



Here comes SANTA ... Let him brighten your days !!!

K8009 $89,95

Y2K ... Time is on your side ! This clock does it all and much more ...
Time / date / temperature / chronometer / scare / etc... and remote control. (optional housing : B8009)

Xmas always a memorable time ! Made even more special *with* innovative *electronics.*

MK116 $19,95
MMK116 $24,95

K : kit version
MK : minikit version
MMK : pre-assembled version

HAPPY HOLIDAYS

velleman

7415 Whitehall Street Suite 117
Fort Worth, TX 76118
(817) 284-7785 F : (817) 284-7712
www.velleman-kit.com email : velleman@earthlink.net

Questions ? Contact us for a list of US distributors or to get your *FREE* catalogue

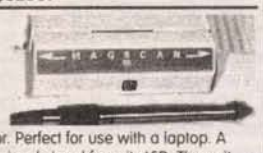
Write in 39 on Reader Service Card.

350MHz, TEKTRONIX 2467, MICRO CHANNEL PLATE CRT! 4 Channels, 500ps per div. in normal room light.

Displays intermittent variations as they happen. Captures the slowest one shot events with 4ns per division a 100 fold increase in the visual writing rate over conventional CRT. Features: 1 ns rise time, 500ps/Div time base, 2mV/Div. vertical sensitivity at 350MHz, 20ps time interval resolution, 1Mohm / 50-ohm input, 500Mhz trigger bandwidth, four channels. On-screen waveform cursors provide vertical & horizontal scale factors, trigger level, voltage, time, freq., phase, ratio values and mode indication. Complete with 2 probes, pouch, and manual. Mint cond. 90 day warranty.

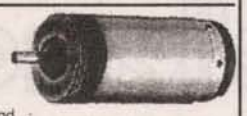
New.....$12K Now TEK2467.....$3250.

MAGNETIC STRIPE READER, with BAR CODE WAND.



New, from United Barcode Industries, MAGSCAN model 1P0-155000-14-01 on-line magnetic stripe and BAR CODE reader designed for compactness and flexibility. The Magscan connects to the keyboard port via the standard mini-DIN connector. Perfect for use with a laptop. A good reed is indicated by an audible beep and a visual signal from its LED. The unit reads track 1, track 2, or track 1 & 2. No software is required. Simply plug it in and start scanning/reading. Very compact: 5"L x 2"W x 1.5"H. No external power is required. 60 page manual included with complete user configuration info. (Done using the wand!) One manual per order. A super hacker device. **SPECIAL...$49ea. or 2 for $79**

MINIATURE and, PRECISE, PORTESCAP, SWISS, GEARMOTOR.



State of the art "ironless" type, mini motor type M11-210-54-0 with approx. 40:1 gearbox. Size: 16mm d. x 43mm L Operating parameters: @6VDC input, 8mA, 141RPM No Load, @ 12VDC input, 12mA 290RPM No Load

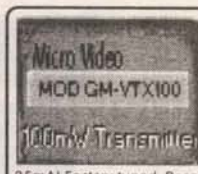
PORTESCAP, TYPE B: $15ea. 2 for $27, Special....10 for $125

ULTRA MINI and WEATHERPROOF, "LIPSTICK" CAM

Sleek black anodized, alum. housing, O-Ring sealed & RAINPROOF. Adj. tilting mount. 1/3" CCD, 380 Lines, 0.3 Lux, AGC, Auto Shutter. 9-12VDC @100mA, 4mm, f1.8, 78° FOV real glass lens, NTSC video. <1ounce! IR SENSITIVE. 23mmdX50mm, 36" cable with BNC video & DC barrel jack.

GM-200K, PINHOLE Model. So tiny you can install it directly into a door. Only a 0.9" diameter hole! Specs as above. 90° FOV Pinhole lens. 1/2 once! Size only 23mm d.x35mm long. Think of the places you could put this little jewel.

GM-200K-STD.....$99
GM-200K-PH lens.....$99



WORLDS SMALLEST ••• 100mW ••• VIDEO TRANSMITTER, ON SALE

Incredibly only 0.9" x 0.8" x 0.37" Transmits crystal controlled hi-res. images with 100mW output! The transmitter you've been waiting for. **Shown actual size.** Much smaller than the 9V battery which powers it. Draws only 35mA! Factory tuned. Receive on cable channel 59. Will work with color or B&W cameras. UHF Bow tie antenna with balun and 3' F cable for TV included. Perfect with our GM1000A. **SPECIAL TVX-100.....$159.**

TVX100 with GM1000A CAMERA....$209.

MOTORIZED LINEAR SLIDE, offers 0.001" per step travel.

A THK, LWL-12 series re-circulationg, ball bearing slide with a 4.7" long steel rail is mounted to a 0.2" thick, black anodized, aluminum plate. The slide has a right angle bracket attached to a spring loaded, anti backlash, drive nut. Riding on a 0.37"diam. 10TPI lead screw which is coupled to one end of a dual 1/4" shaft , stepper motor with specs: 1.8° /step, 5V @1Amp, 4 wire. One optical end of travel sensor is also in place. Ex. Cond. Ltd. Qty. **LWL12-2.5adapter.....$59ea.**

NEW! 0.008lux, COLOR NIGHT VISION CAMERA! UNBELIEVABLE LOW LIGHT PERFORMANCE. Our GMV-2K, DOES it in COLOR TOO!

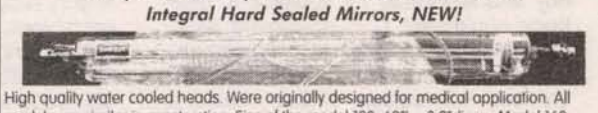
For covert, military & scientific applications that must be color, this is it. Performance is enhanced through low speed electronic shuttering and digital frame memory. With the optional, auto iris lens, 24 hour monitoring is possible. Auto sensitivity mode starts as it becomes dark. Eight Gain/Shutter modes are user selectable. Normal, X4, X8, X16, X24, X32, X64, X128. These provide frame rates of 60, 15, 8, 4, 3, 2, 1, and 0.5 per second. Auto/Man. white balance. Alum. housing, dual 1/4x20 mtg. Specs: 1/3" CCD, with 291K pixels, 320 Lines, 12VDC @200mA, Std. video out on BNC. Size: 54mmx50mmx94mm long. With pwr. adapter. All functions can be externally controlled via an 8 pin mini DIN. Use std. c-mnt lens not incl.

GMV2K...$549ea. OPT. 4mm, f1.4 A/I lens w/cable $119

CLOCK RADIO. COVERT CAMERA, New, Magnavox clock radio with covert low light video camera. Specifications per our GM1000A shown on page one. Connect the output to anything with a "video Input" jack. via RCA style ouput.

SPECIAL,CRC-1-STD,.....$119.ea

CO2, 120Watt CW, SEALED GLASS LASER HEADS Integral Hard Sealed Mirrors, NEW!



High quality water cooled heads. Were originally designed for medical application. All models are similar in construction. Size of the model 103: 60"L x 3.2"diam., Model 160: 44"L x 3.2"diam. Model 135: 35"L x 3.2"diam. Power requirement, model 103, 40KV trigger with 25KV @ 10 to 30ma operating current. Model 160 and 135, 30KV trigger with 15-20KV @ 7 to 20mA operating current. These are not toys. They must conform to Class IV CDRH regulations when assembled into a functioning system. Perfect for engraving, cutting and drilling most materials. Only three available. We don't expect any more.

Limited Qty...100+Watts.....$1475., 60Watts...$1095., 35Watts.....$895.

SONY, ROBOTIC, COLOR CONFERENCE CAMERA, 450Line, 8X, NTSC & Y/C OUT, Serial Control of Pan, Tilt, Zoom, Auto Iris and Auto Focus too!

Like having your own R2D2. Intended for use in fortune 500 board rooms. The video performance is stunning. Superior to almost anything we have seen. Camera and lens is an integral assembly. Excellent Condition. Rugged black ABS enclosure. 8 pin mini-DIN & Std. SVHS jack. Size: 8"Dx6.5"H. Data on using the serial port ios provided. The units self test on power up and the video is active. Reg price over $4K **SPECIAL PRICE....$249ea.**

NEW, 2.4GHz VIDEO + STEREO AUDIO TRANSMITTER with SONY, CCM-PC5 COLOR CAMERA.

Originally sold for $500! Now available for a fraction of that price. Great looking styling. Camera has a very stable, adjustable tiliting base, front panel LED pwr. indicator and sensitive built in electret mic, providing excellent audio and video performance from one compact package. Simply connect camera to the completely self contained 2.4GHz transmitter. All cables supplied. You can transmit up to 700 feet clear line of sight! Companion matching receiver works with any TV or VCR. Internal patch antennas. Camera has adjustable focus 6mm lens. (1" to infnity, macro capable) Auto power off when the privacy shutter is closed. Power is 7-13VDC. (all pwr. adapters and cables included) 1/3" CCD, 330Lines res. 35% better than standard VHS! Can als be used to transmit VCR oputput to another TV for remote viewing. **SONY-ASTROVIEW COMBO..$189ea. or 2/$339**

2.4GHz TRANSMITTER & RECEIVER.....$129 pair.
SONY COLOR CAMERA with AUDIO.....$69ea.

PORTABLE MINI PRINTER, 40 COLUMN, with INTERNAL NI-CAD POWER!

The model SD222-1000 is a NEW and very cool, self contained, alphanumeric, impact type printer. It features a standard parallel port and an internal Ni-Cad power supply. Can also be powered via the 9VDC power adapter supplied. Uses standard 2" wide paper rolls available everywhere. Has self test function and diagnostic mode. Can emulate Epson and Citizen 560. It will print from the LPT port of your PC. Very rugged and well made. Perfect for any remote printing or data logging application. Size: 8"L x 4.1"W x 3.5"H.

OUR PRICE.....$49ea. or 2 for $75

NEW, "STEALTH CAM", MICRO SIZE, with AUDIO!

The sleek aluminum housing fits like a glove! Removeable mtg. bracket & a 1.3M cable with BNC vid., RCA aud., (internal mic) & DC pwr. jack for, no sweat hook up. Why fool around with an open P.C. board? Now you can have the "STEALTH CAM"•1/3" CCD •410 Lines•0.3 Lux• AGC•Auto Shutter• Pwr. 12V @110mA•250k pixels•Std. 4mm, 78° FOV lens•Pinhole, 90° FOV• Focus:10mm to inf.•NTSC video•<ounce!•IR SENSITIVE•Size Std: 30mm sq. x 29mm d. PH: 16mm d. Don't confuse with LOW RES., HIGH LUX C-MOS CAMERAS. ***GM-2000S-STANDARD OR PINHOLE, w/aud., XMAS SPECIAL...$69***

HAPPY HOLIDAYS!

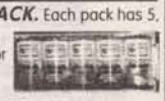
RESOURCES UN-LTD.

VISA, MC, AMEX, DISCOVER, COD.
ORDER: 800-810-4070 TECH: 603-668-2499
FAX: 603-644-7825 E-MAIL unltd4u@m20.net
300 BEDFORD STREET, MANCHESTER, NH 03101

NEWPORT TRANSLATION STAGES.

MODEL:	DESCRIPTION:	EACH
605-4	With differential Mic.	$849
605-4	With Screw Adjust	$449
600A-3	W/Micrometer Adj.	$159
270	LAB JACK	$249
RSA-2T	360 deg. Rotary Stage	$129
625A-4	Laser Holder	$149
481A	Rotary Stage	$189
M36	Translation Stage	$249
460A-XY	X-Y Translation Stage	$189
460A-XYZ	X-Y-Z Translation Stage	$299
M37	3 Axis Trans. Stage	$289
415	Vertical Trans. Stage	$129
M360-90	Mnting. Plate 90deg.	$ 29
M436	Translation Stage	$199
M150	Magnetic Mtg. Base	$129
420	Linear Trans. Stage	$119
CYM-2	Square mnt. (Screw)	$ 99
13270	ORIEL Adj. IRIS	$ 99

10V @ 2.5 AH SEALED, LEAD ACID, PACK. Each pack has 5, 2 Volt cells. 'D'size cells are arrainged as 1X5 cells. Enclosed in an ABS outer shell. (removed for photo) Perfect for high drain applications. Make custom packs of any rating. Size: 7.5"L x 2.8"H x 1.5"D **SALE! 6-five packs for $20, 40 for $99**



NOW YOU CAN SEE WHAT THE "FISHES ARE DOIN' (down 60 ft.) UNDERWATER B&W CAMERA with INTERNAL, INFRA-RED ILLUMINATOR!

Sleek black anodized, BRASS, housing. O-Ring sealed & WATERPROOF. Adjustabe mount incl. Specs: 1/3" CCD, 400 Lines res., 0.05 Lux sensitivity, AGC, Auto Shutter. 12VDC @225mA, 4mm, 78° FOV lens, A real glass lens. NTSC video out. Superior construction. SENSITIVE to IR. Ultra small Size only: 1.25"diam. X 2" long. With 60 ft. cable. Perfect as a remote aresa inspection camera. Great for general outdoor use as well. **GM-300KIR.....$179**

NEW, GM960 TIME LAPSE VIDEO RECORDER

Finally a brand new, 4 head, T/L recorder with all the features at a price you can afford. Features: • Up to 960 hours on a standard T-120 VHS tape.• 12 different modes for record and playback • Audio recording in the 12H and 24H mode. • 30Day memory backup • Easy mode setting • On- screen menus • Auto-Repeat recording mode • Serial or One-shot recording • Time, Date, speed, and Alarm indicators on screen. These deluxe units are front loading and are 14"W x 3.5"H x 12.2"D, 110VAC powered. **SPECIAL.....$699ea. or 2 for $1349**

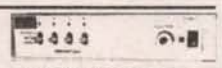
FUTABA, 2X20 VACUUM FLUORESCENT DISPLAY MODULE

New or like new, model M202SD series. Can directly replace LCD displays. The module includes the VFD, microcomputer and driver. Connects directly to the system bus. Display up to 40 dot matrix, 5 x 7 characters (222 characters and symbols), 5mm H x 3.5mm W with cursor. Display color is green at 505nm. Brightness is 690 cd/m² with four level dimming function. Weight: 5 oz. Size: 6.7"L x 2.6"H x 1" thick. Power required is 5VDC @ 350mA. Serial or parallel interface selectable. Perfect for any high visibility display requirement. With data. ***SPECIAL FUTABA.....$15ea. 3 for $39***

DAYLIGHT/LOW LIGHT MINI CAM & A/I LENS, For dawn 'till dusk applications.

Rugged alum. housing, dual mtg. sockets. 1/3" CCD, 420 lines res., 0.1 Lux sens., AGC, 12VDC @120mA. Take full advantage of camera sensitivity with super, 4mm, f1.4, 78° FOV Auto Iris lens included. BNC video out. 50mm sq. X 65mmL. With pwr. adapt. **SPECIAL, GM-510A/I...$189 or 2/$349**

NEW! 4 or 8 CHANNEL, SEQUENCER



Model GM34 or GM38. Connect to any four standard video signals and they will be sequentially output to the dual rear panel BNC outputs. Front panel user adjustable, variable dwell 1 to 15 sec per channel. Auto or manual switching with channel bypass. Compact only 8.6"W x 3.7" D x 1.75" H, ac powered. Video loop through. **Special, GM-34..$69, GM-38..$89**

SUPER, MINI C-MOUNT CAMERAS, Super sensitive, GM410 or the general purpose GM412,

The GM-412 specs: B&W, size 1.5"sq. X 2.4"L, 250,000 Pixels, **380** Lines Resolution, Sensitivity **0.3** Lux, The GM410 specs: size only 1.5" SQ. x 1.6"L, >270,000 Pixels, **410** Lines Res., Sens. **0.05 LUX.**, Both cameras are 1/3" CCD with AGC & Electronic shutter. 12V @110mA power. NTSC out. IR SENSITIVE, BNC video out, Both use std. DC pwr. jack. Aluminum housings with dual threaded top and bottom mounting. True performance not hype! These cameras will outperform *ANY* camera in this magazine. Multi-lens options are available to exploit their superior performance.GM412 shown bottom. GM410 shown top.

GM412, less lens..$119,
GM410, less lens..$169

low cost MICRO CAMERAS, w/audio 1/3" CCD, 410 Lines Res., 0.3 Lux sens., AGC, Auto Shutter. Pwr. from 9 to 12VDC @100mA, 250k PIXELS, Std. model, 4mm, 78° FOV lens, Pinhole, 90° FOV. A real glass lens. Both focus from 10mm to infinity. Std. NTSC video out. 1/2 ounce! SENSITIVE to IR. Size Std: 1.25"sq. x 1"d. PH is 0.6"d, 1.6M long wiring harness with connectors included. WARNING: Don't confuse these models with LOW RESOLUTION, HIGH LUX C-MOS CAMERAS.

GM-1000A-STD.....$59 GM-1000A-STD/Aud.....$64
GM-1000A-PH.....$59 GM-1000A-PH/Aud.....$64
GM-1000A-CMNT..$59 GM-1000A-CMNT/Aud.$64

Micro Lenses for GM1000 series

2.5mm, 150°.....$22	8.0mm, f2.0.....$22
4.3mm, 78° f1.8.....$22	12.0mm, f2.0.....$22
6.0mm, f2.0.....$22	5mm, 70°PH.....$22

C-MOUNT LENSES

LOW LIGHT	STANDARD
16mm, f1.6, 15° FOV $39	4mm, 80° FOV $24
8mm, f1.3, 40° FOV $49	8mm, 40° FOV $24
4mm, f1.4, 78° FOV $49	12mm, 28° FOV $24

Please fax us your list of unique surplus material.

MOTORIZED ZOOM LENS SPECIAL 6X magnification, 12X on a 1/3" camera! Auto iris too!

New, fabulous hi-res. optics with std. C-Mount. Superior Fujinon and Vicon lenses. Normally cost from $600 to $1500. There is no substitute for a good lens! All drive motors will operate from 6-12VDC. Auto iris has a built in amp which works with any cameras video output for control.

Type B-6, 12.5 to 75mm, 6X, f1.2 ..... $179 or 2 for $349
ZOOM LENS CONTROLLER, NEW $169

END FIELD of VIEW GUESSWORK! 3.5 to 8mm VARI-FOCAL LENS

Brand New, super f1.8 lens allows you to smoothly adjust from a 97 °FOV @ 3.5mm to a 44° FOV @ 8mm. Now you can frame your area of interest just the way you want it! Standard CS-Mount with adjustable focus and iris.

SPECIAL.....$89ea. or 2 for $169

NEW, TRIPLE OUTPUT, 60W, POWER SUPPLY

Astec model: SA40-1313, outputs of +12VDC @ 3Amps, +5V @ 5Amps and -12V @ 350mA. 110VAC input. Very compact size: 3"W x 5"L x 1.3"H Perfect for many hobby applications as well as an external disk drive power supply.

SPECIAL.....$5ea. or 5 for $20

DEL TRON LINEAR SLIDE with CLEVER LEVER

An interesting assembly, consisting of a Del Tron mini linear, ball bearing slide (2.5"L x 1"W x 0.56"H) with 2" travel. Slide is placed next to a 2" diam. stepper mounted wheel. A 1.5" sq., Four wire stepper, rated at 4V, 0.95A, 1.8°/step. The bottom side of the wheel acts as a cam with roller and moves a spring loaded arm (3.4"L x 1"W) up and down 1/2". All components, including an optical end of travel detector are mounted on precision machined, 0.2" thick, black anodized aluminum. Overall size: 8.5"L x 3."D x 2.5"H.Ex. Cond. Ltd. Qty.

DelTron-W.....$39ea.

COMPACT, THK, LINEAR SLIDE with STEPPER DRIVE,

A really slick, super precision, THK LWL-12 series, recirculating ball slide with a 3.6" long toothed rack (14TPI) mounted next to the rail. The rack mates with a 0.6"diam. nylon drive gear mounted to a compact, (1.5" sq.), Four wire stepper, rated at 4V, 0.95A, 1.8°/step. One full step moves the slide approx. 0.050". All components, including an optical end of travel detector are mounted on precision machined, 0.2" thick, black anodized aluminum. Overall size: 5.5"W x 3.3"D x 3.4"H. The system provides 3.1" of extremely rigid travel. Ex. cond. Ltd. Qty. **LS-LWL-12....49ea.**

Write in 152 on Reader Service Card.

ORBITAL E-MAIL — AN AFFORDABLE SOLUTION

by Gordon West

The little handheld data communicator from **Magellan Corporation** has become a real favorite among hikers, RVers, boaters, and backpackers. Short E-Mail messages are composed on the little keyboard, sent to an orbiting Orbcomm satellite, and received back down on earth to the directed party within minutes. And the same thing happens in reverse — anyone may E-Mail *you* on your little Magellan GSC-100 handheld; and if you regularly check in with the satellite, you could get your message within minutes on the little tiny LCD screen.

E-Mail even in the steep cliff areas of Bryce Canyon, Utah!

E-Mail from the pastures of Colorado.

Working the GSC-100 on the test bench before the RV or boat trip.

Best of all, this service is not outrageously expensive — from $30.00 to $50.00 per month depending on the volume of incoming and outgoing E-Mails, or as little as $39.95 a month if you keep your E-Mails to less than 10 messages per month, up to 500 characters per message, and $99.00 equipment-cost from one supplier.

THE SPACE COMPONENTS

The 28 low-earth-orbit satellites are a partnership owned by Orbital Sciences Corporation, Dulles, VA, and Teleglobe, Inc., of Canada. This Orbcomm partnership provides two-way monitoring, tracking, and messaging services through these 28 low-earth-orbit satellites. Some of the applications include monitoring of electric utility meters, oil and gas storage tanks, wells, environmental projects, tractor/trailer vehicles, rail cars, heavy equipment, fishing vessels and, for us, data messaging for the recreational land and sea explorers.

The satellites are launched into their low earth orbits by the Delta and Taurus rockets, and not by the space shuttle. There have also been successful launches of these satellites from rockets carried by high altitude aircraft.

The Orbcomm system has absolutely *nothing* to do with the Motorola Irridium system — the Motorola Irridium system was intended for digital voice messaging, and the Orbcomm system is designed specifically for low-cost data messaging. While there has been much attention on the Motorola Irridium system (some good, some not so good), the Magellan Orbcomm system has quietly become the number one choice for low-cost handheld messaging.

The Orbcomm satellites are in five low-earth-orbit planes:

A-plane: 45 degrees (eight satellites)
B-plane: 45 degrees (eight satellites)
C-plane: 45 degrees (eight satellites)
F-plane: 70 degrees (two satellites)
G-plane: 108 degrees (two satellites)

There has almost *always* been a satellite in view during the last full year of testing I have done at sea and on land with my Orbcomm Magellan GSC-100 data communicator. One time I think I had to wait for about 15 minutes for a favorable pass down low in Bryce Canyon.

A "straight shot" to the satellites is necessary because they require a modest signal at 148 MHz-150.05 MHz to receive the 2400 bps data-stream. The orbiting satellites transmit back to the handheld communicator at 137 MHz-138 MHz, 4800 bps.

"Our satellites are controlled via our network control center in Dulles, VA," comments Wende Cover, Director of Marketing Communications at Orbcomm.

Check out Magellan's website at www.magellangps.com or call them at 1-800-669-4477

"Our satellites will transmit to four Gateway earth stations — one here in Washington, D.C., or one in New York, or one in Georgia, or for the West Coast, one in Arizona," adds Ms. Cover.

Since the 28 satellites — many of them launched by an L1011 aircraft on a Pegasus rocket — cover all of the world with E-Mail capabilities, my next question was where in the world can you use the equipment? Last year, I had tried unsuccessfully to E-Mail from England, and while my equipment could see the Orbcomm satellites, I couldn't get through.

The answer to where in the world

ORBITAL E-MAIL — AN AFFORDABLE SOLUTION

In the USA, Canada, and Mexico, we would signal in the "standard" mode (store and forward not needed).

Checking the Orbcomm satellite pass.

Reviewing incoming E-Mail headers.

you can use the system depends on what piece of uplink equipment you are operating, and what agreements *they* have with each country. Since my equipment was from Magellan Corporation, I found out quickly that they have recently acquired rights in most of the European countries for unlimited use of their equipment abroad.

For sailors out on the high seas, they will always be able to see the low-earth-orbit satellites, but the satellites might not be able to see a Gateway earth station. When this occurs, the satellites will go into a "store and forward" mode where your message is held in space until the satellite passes over a ground receiving station. This is no big deal — it might take an extra 30 minutes to finally get your message across the seas.

"Check us out on the web at www.orbcomm.com/globalgram," adds Ms. Cover. It's a great web site.

HANDHELD COMPONENT

Chances are you have heard the name Magellan — especially if you are into boating, flying, or backpacking with handheld GPS equipment. Magellan and Garmin are the two leaders in recreational GPS equipment, and right now Magellan is coming out smelling like a rose because most of their GPS receivers passed through the end of week rollover last August without so much as a hiccup. Garmin GPS equipment was not as lucky. But Garmin does a fabulous job in working with the users to help them get back up to GPS speed.

The Magellan "ground component" of the

We accept Visa, Mastercard, AmEx, and Discover

Attention: Gearheads

www.shrevesystems.com

To Order Call 1-800-227-3971 Fax: 318-424-9771

PowerMac 7200
75 Mhz PPC 601
4 168 pin DIMM slots
Build your own Mac!
$79 Brand New!

Peltier Junction
with heat sink
1 3/16îx 1 3/16î
$10 each or 3 for $25

Apple Color Composite Display
Great for Surveillance
Refurbished $69

Apple IIE Logic Board
$19

LC Power Supply
+5V, -5V, +12V Output
$5 New

Global Village Bronze
External Modem
2400 Bps/9600 Fax
$1 Each

CMS Tower SCSI Case **$99**
Holds 4 5.25 full height drives

Monitor Blowout Sale!
19" Color Monitors
Ridiculously LARGE!
Ridiculuosly CHEAP!
ONLY $49

"As Is"
No cables

$19
MacAlly ADB Keyboard

PDA Genuine Leather Carry Case
Let your palm pilot lead the life of luxury!
$10

Apple LW Personal NTR with Toner
$399

Apple Remote Control
$1 EACH

RAM

1 MB 30 Pin	4 For $1
4 MB 72 Pin	2 For $5

Claris Works 3.0 For PC/Mac EDOCS $29

Miscellaneous

Apple 8 bit Video Card	$19
LaserWriter IINT	$199
Apple ADB Keyboard	$19
1.44 Super Drive	$19
Clone ADB MouseII	$129
Quicktake 100 Camera	$10
Bernouli 90 MB EXT	
Epson Document Scanners	$29
44MB SyQuest Ext	$10
88MB SyQuest Ext	$19

Membrane Track Pad for laptop $2

$25 minimum order

Shreve Systems
1200 Marshall st
Shreveport, La 71101

Returns subject to a 15% restocking fee.
Prices are subject to change without notice. We accept Visa, Mastercard, AmEx, Discover

Write in 188 on Reader Service Card.

ORBITAL E-MAIL — AN AFFORDABLE SOLUTION

Orbcomm system is a 30-ounce handheld two-way radio communicator, Model GSC-100. It transmits 2400 bps up, and receives 4800 bps back from the satellites on the 138 MHz and 148 MHz VHF band. The Magellan GSC-100 also contains a Magellan GPS receiver, so what you carry is both a two-way data communicator to the Orbcomm satellites, as well as a built-in GPS receiver capable of finding your position down to the radius of a 100-meter circle.

The Magellan GSC-100 operates for about six continuous hours on a 9.6 volt, DC, rechargeable, nickel cadmium battery pack. The pack fits into the rear of the units, and spare packs are available for a plug-in quick swap-out. The portable system is also shipped with an AC adaptor cable, and may also be ordered with a 10-30 volt DC external power cable. The external cables plug into the side of the unit with a screw-lock sleeve. The eight-pin proprietary plug receiver also carries pins for NMEA and RS232 transmit and receive data. Magellan offers a complement of accessory cables that could give you the option of running several things in parallel from this single port.

There is also an additional output jack for an external GPS antenna, as well as an external VHF Orbcomm antenna for data transfer. But you don't need external antennas to operate this equipment in the totally portable mode — there is a yard-long telescopic whip that may be extended for data transmission and reception, as well as a patch antenna built in for simultaneous GPS positioning.

To get started operating the equipment, you must first be registered for Orbcomm service. This is done at the time of equipment purchase for a one-time registration fee of $49.95. The selling dealer will assist you with registration and the entering of your unique E-Mail number in the equipment. This E-Mail number will be the same number that your friends or the office will send E-Mail to when you are out in the yonder using this equipment far from conventional telephone lines.

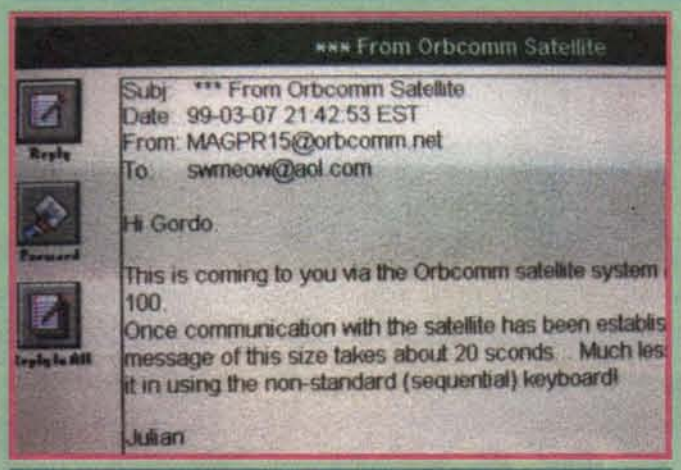
The equipment may be purchased or leased through authorized selling dealers. Right now the equipment sells for $999.00, but I understand a prominent marine electronics chain is now offering a package plan where you might be able to score a brand new receiver for under $99.00 if you'll commit to three years of service at $39.95 a month. This is identical to cell phone marketing — just about give away the handset, and offer a three-year service commitment (West Marine 1-800-262-8464).

And I don't suggest you sign up early — I'm not aware of a plan that would allow you to deactivate your monthly service for a few months when you are stuck at the office and won't be able to take some vacation time. Once you sign up, use it or not, your minimum is $39.95 a month. But hey — for what the GSC-100 can do, it's nice to know you can grab your equipment and go at a moment's notice and be able to send E-Mail almost anywhere in the world.

Once your equipment is registered and you are all set to do your first E-Mail wireless test, turn on the GSC-100, and let the GPS initialize and come up with your position. This automatically transfers over to the built-in satellite almanac, and you will constantly receive on-screen messages that will tell you exactly where the E-Mail satellites are, how long the pass may last, or when the next satellite is expected to come up over the horizon. As I mentioned before, the longest you may need to wait is only five or 10 minutes for the next passing low-earth-

Write in 189 on Reader Service Card.

ORBITAL E-MAIL — AN AFFORDABLE SOLUTION



Outgoing message sent to the Magellan data communicator.

orbit Orbcomm satellite.

To compose and send an E-Mail, you simply press the MSGS soft key from the main menu, click on a standard "GlobalGram," enter the recipient's E-Mail address, choose CC or not, key enter the subject, and then up comes the 2000 character text screen for sending a standard GlobalGram message. If you're way out on the other side of the world, far away from any earth station, you must go into the store and forward mode where your message is limited to a short 229 character text.

It's a little tedious punching out your message on the A to Z built-in keyboard, but you are not charged for keyboard entry time, so take your time and do as many abbreviations as you can. Remember, if you exceed 10 GlobalGram messages per month, up to 500 characters per message, you pay an additional one cent per character.

Your character message count also applies to incoming messages. Be sure and let everyone know ahead of time that your system is designed for telegram-type messages, not regular E-Mail messages that could easily eat up your monthly free message units. I tell everyone no more than two or three lines of computer text, using as many abbreviations as possible.

This will probably be the toughest part of running this equipment — keeping incoming messages short and concise. Since your friends and workers out there in E-Mail land are using a computer, it's easy for them to compose and send an extra long message without realizing you are only looking for two or three lines of text.

To send your text that you just composed on the screen, pull up the telescopic whip, stand in an area that shows you an on-screen strong satellite signal, hit the send soft key, and that's it. If your screen says you've got five more minutes until another satellite comes up, hit the send soft key anyway, and walk away from the equipment. It will automatically catch the next satellite, upload the message, and give you a confirmation that it was properly entered into the E-Mail system.

The port seen here takes the power plug for external AC or DC operation. The lower jack is for the antenna.

The data communicator is also a GPS receiver, too!

Your equipment will also download any E-Mail messages holding. The screen will tell you how many E-Mails you have waiting, presently stored in your equipment's memory. You read them "off line" at anytime. This means you don't need to stand there with the antenna pointing in the air to look at the incoming messages.

And, if you want to reply to the incoming message, it's just a few keystrokes to transfer the message address into the send address, and away you go with your text. You also have mailboxes where you can store E-Mail addresses.

NO E-MAIL — NO PROBLEM

You are out in the boondocks, and your sister sends you an E-Mail that mom finally got over her pneumonia and is out of the hospital and back home again. You want to send mom a welcome home message, but she doesn't have a computer. No problem!

Type up a short message for mom, and address it through the Orbcomm operator in Dulles, VA. For only $3.00, the message from your handheld communicator will be spoken over the telephone by a friendly Orbcomm operator, just for mom! And certainly mom will want to say a few words back to you, so a few minutes later one more buck buys you a screen message that says, "... How sweet of you to think of me out in the boondocks ...," or something like that.

In fact, I use this "Orb2y" service a lot for my computer eloquent friends when I tell them the only way they can reach me on my data communicator is to *say* their short message to an operator that will then transcribe it and deliver it to me. I also leave a message with the Orbcomm service that tells any incoming callers to say their piece in less than 20 words. This prevents someone from filling up my account with costly diatribe that I really don't want to read or pay for.

ACP's 95th GIANT COMPUTER SWAP★MEET

Orange County's Original!

All Day Sunday 8am-2pm

Jan 30th

Be a Seller ...for your space Call Mary

FREE Admission & Parking Shop 100's of Sellers

in ACP's Giant Parking Lot !!!

Advanced Computer Products, Inc.

ACP SUPER★STORE

Since 1976

1310 E. Edinger
Santa Ana, CA
714-558-8813

CABLE TV CONVERTERS

★ ★ ★ ★ ★

Raven-85 plain converter: 85 channel, Ch-3 output, PG Lock, HRC/STD and sleep timer

Raven-99 plain converter: 99 channel, Ch-3 output, PG lock, MFT/Fine tuning, HRC/STD and sleep timer

Raven-135 converter: Volume control, 135 channel, Ch-3/4 output, PG lock, HRC/STD and sleep timer, audio & video output through RCA jacks

Raven-125 converter: Volume control, 125 channel, Ch-3/4 output, PG lock, HRC/STD(by remote unit) and sleep timer, audio & video output thru RCA jacks

FREE BROCHURES & PRICE LIST
CALL (310) 515-5085 or
FAX 1-800-579-5000
• **PCW Company**

Write in 190 on Reader Service Card.

ORBITAL E-MAIL — AN AFFORDABLE SOLUTION

Orbcomm is also offering additional services, and this includes weather and may soon include selected news or stock reports.

The recreational user of the GSC-100 is just a micron of the total Orbcomm service. This means calling up Orbcomm or Magellan and trying to get user information about their equipment or service is downright frustrating. I asked the simple question on whether or not my equipment would work in England. Orbcomm says the satellites work anywhere in the world, but tells me to call Magellan to see if we have an agreement with the host country. You call Magellan, and they tell you to call Orbcomm to see whether or not *they* have an agreement.

I ultimately get the answer that it will work throughout most of Europe and most definitely will work from Alaska to South America, but both companies continue to pass the question back and forth hoping someone will take responsibility for the answer.

And now for things they won't tell you about in the book or at the companies ...

Yes, the equipment will upload and download messages quite nicely with the antenna horizontal to the ground up inside a fiberglass roofed motorhome or boat cabin. Yes, the equipment is sensitive to external ignition noise, so don't try and download any messages with the antenna near the engine compartment.

No, the equipment and service has absolutely nothing to do with the Motorola Irridium system. This is actually competition. And it appears Orbcomm/Magellan is winning, hands down.

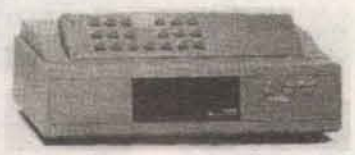
Yes, long-winded data senders can push your monthly bill up to around $80.00. But if you selectively only give out your GSC-100 E-Mail address to those who know the GlobalGram system, your monthly bill will probably be much like mine — under $45.00 a month for a good amount of uploading and downloading SHORT E-Mail communications.

Yes, the equipment worked satisfactorily in the heavy forest. At times, we were unable to get GPS satellite reception, but we could still see the incoming signal strength of the E-Mail satellites.

No, it won't do voice. Yes, there is error correction so the Orbcomm service knows that you have successfully downloaded E-Mail traffic.

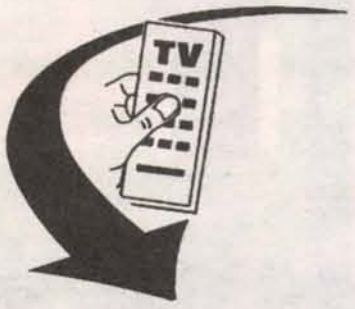
And, yes, this device can be a lifesaving tool in case of an emergency and you have no other way to signal for help. Most recently, some boaters started to sink hundreds of miles offshore, and their emergency Mayday message on their GSC-100 with the embedded latitude and longitude was able to get help from a nearby marine rescue agency. Had it not been for their GSC-100, they would have surely gone down with the ship. You could get the same kind of emergency help if you were stranded in the desert, marooned on a mountain peak, or simply snowed in out in the forest. A simple solar charger could easily supplement the internal nickel cadmium batteries for extended periods of use away from home.

So, if you can't leave without E-Mail, the Orbcomm system is now in its third year of success, and "specials" on equipment acquisition may soon become available if you start shopping for the GSC-100 down at the local marine stores. NV



TZPC-175 Converters

$39.00
20-lot



THE BEST DEALER PRICING

✔ Call for other models
✔ One stop shop
✔ Same day shipping
✔ One full year warranty

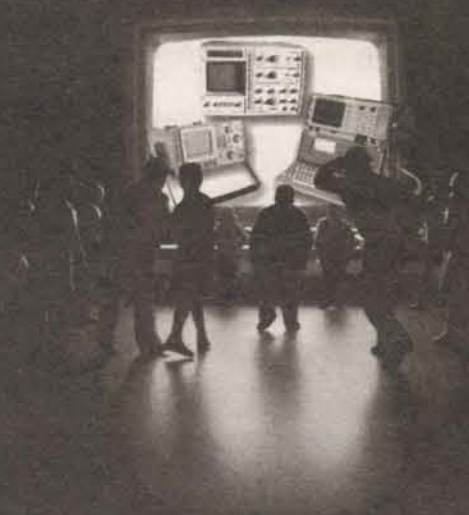
Centurion: CF-3000 (Brand New) True, 99-Channel

$49.00
20-lot

Intek Electronic Systems
405-634-1535

Write in 191 on Reader Service Card.

ELECTRONIC TEST EQUIPMENT?



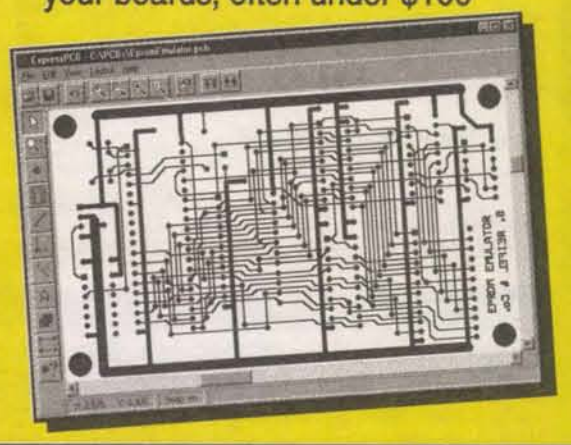
www.levylatham.com

Private Marketers of U.S. Military Surplus Assets

Write in 192 on Reader Service Card.

PCB LAYOUT
Software For Windows - *FREE*

1. Download our board layout software
2. Design your 2 sided plated-through PCB
3. Send us your layout over the Internet
4. In 2-3 business days, UPS delivers your boards, often under $100



www.expresspcb.com

Winter Special

ATTENTION PAID SUBSCRIBERS:
Receive a 15% discount off the listed price shown here instead of the usual 10% discount!!
Offer valid Nov. 1, 1999 through Dec. 31, 1999.

BOOKS PUBLISHED BY MCGRAW HILL

$39.95
"Encyclopedia of Electronic Circuits" Vol. 7 by R. Graff

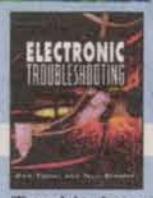
An extensive library of 1,000 circuits from the bestselling, seven-volume "Encyclopedia of Electronic Circuits."

$34.95
"Programming and Customizing the BASIC Stamp Computer" by S. Edwards

Build smart electronics projects with the inexpensive, simple-to-use, surprisingly powerful BASIC Stamp.

$44.95
"Handbook of Radio and Wireless Technology" by S. Gibilisco

A comprehensive compendium on the entire field of radio and wireless technology.



$34.95
"Electronic Troubleshooting" by D. Tomal and N. Widmer

Troubleshoot and repair any type of electronics with this comprehensive guide.

$54.95
"Handbook of Microcontrollers" by M. Predko

This much-needed reference is the first to cover all the most common types of eight-bit microcontrollers.

$39.95
"Circuit Troubleshooting Handbook" by J. Lenk

This handbook gives full descriptions of the operation of important circuits, and how each circuit's characteristics may figure in its failure or poor performance.

$39.95
"Programming and Customizing the 8051 Microcontroller" by M. Predko

This tutorial/disk package details the features of the 8051 and demonstrates how to use these embedded chips to access and control many different devices.

$24.95
"How Electronic Things Work ... and What to Do When They Don't" by R. Goodman

Never again be flummoxed, flustered, or taken for a ride by a piece of electronic equipment with this fully illustrated, simple-to-use guide.

by Joseph J. Carr

SECRETS OF RF CIRCUIT DESIGN

$29.95

From one of today's most respected electronics authors comes this pragmatic, intermediate-level guide to designing, building, and testing all types of radio frequency circuits. Filled with functional projects that demonstrate the principles of RF circuits, this revision of a bestseller also provides a handy parts list and sources of components.

PRACTICAL ANTENNA HANDBOOK

$49.95

The most popular book on antennas ever written, widely known as "the antenna builder's bible." This *Third Edition* is a work for anyone with an interest in antennas, from the newest of novices to the most experienced engineer. This empowering book gives you all kinds of projects and material that explains why what you did works.

OTHER AVAILABLE TITLES ...

"The Illustrated Dictionary of Electronics" *by S. Gibilisco* **$39.95**

"The Robot Builder's Bonanza" *by G. McComb* **$18.95**

"Programming and Customizing the PIC Microcontroller" *by M. Predko* **$34.95**

"How Radio Signals Work" *by J. Sinclair* **$24.95**

"Making Printed Circuit Boards" *by J.L. Axelson* **$22.95**

"TAB Encyclopedia of Electronics for Technicians and Hobbyists" *by S. Gibilisco* **$69.50** *(Hard Cover)*

"How to Read Electronic Circuit Diagrams" *by R.M. & Lawrence Brown* **$19.95**

"Build Your Own Test Equipment" *by H.L. Davidson* **$22.95**

"Radio Receiver Projects You Can Build" *by H.L. Davidson* **$21.95**

"Basic Electronics Theory" *by D.T. Horn* **$26.95**

OTHER AVAILABLE TITLES ...

"Troubleshooting and Repairing Consumer Electronics Without a Schematic" *by H.L. Davidson* **$24.95**

"Amateur Radio Encyclopedia" *by S. Gibilisco* **$50.00** (Hardcover Only)

"Ready-to-Build Telephone Enhancements" *by D.T. Horn* **$17.95**

"The Benchtop Electronics Handbook: 260 Most Common Popular Electronics" *by V. Veley* **$65.00** *(Cloth Cover)*

Send check or money order to Nuts & Volts, 430 Princeland Court, Corona, CA 92879. Include a complete shipping address (no P.O. Boxes, please). Shipping & handling $4.50. CA residents add 7.75% sales tax. Or, call our toll-free order-only line at 1-800-783-4624 and use your MasterCard or Visa. *ALL ORDERS MUST BE PREPAID.*

Call 1-800-783-4624 today!
WE ACCEPT VISA AND MASTERCARD

* SANTA SPECIAL *

GIFT SUBSCRIPTIONS HALF PRICE!!

That's right!

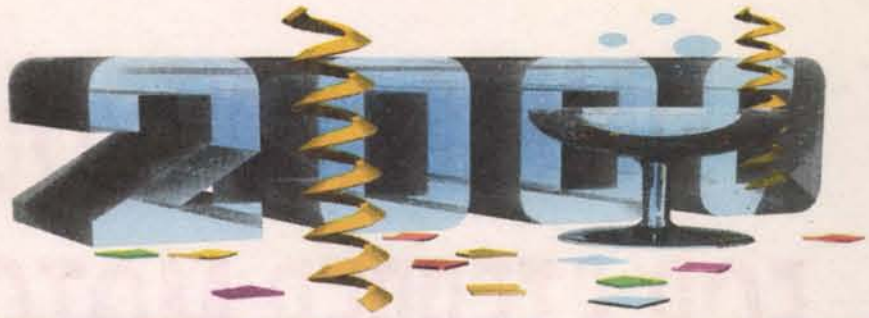
Buy or renew your own subscription to *Nuts & Volts* at the regular price, and order a second subscription to give to a friend or family member and pay *half* the regular rate!!

Along with *your* regular price subscription order, include the name and address of the person to receive the gift subscription, and we'll send them a special holiday card announcing their gift.

Offer applies to any length, PREPAID USA-delivered subscriptions only!! Half price offer cannot be used to extend one subscription.

NUTS & VOLTS MAGAZINE
430 Princeland Court, Corona, CA 92879
909-371-8497 • 909-371-3052 FAX
Subscription Order ONLY Line 1-800-783-4624
E-Mail: subscribe@nutsvolts.com

Offer expires January 1, 2000



Be a winner in the new millennium!

As a paid subscriber to *Nuts & Volts*, you will be automatically entered *each month* in our prize drawing!

And you won't want to miss a chance at this month's prize ...

A BASIC Stamp Super Starter Pack from Parallax!!

This package includes all of the parts and pieces you'll need to learn the BASIC Stamp, build a robot, or simply interface the microcontroller to other circuitry.

The $500 value includes:

- BASIC Stamp Manual Version 1.9
- Board of Education Robot (Boe-Bot)
- BASIC Stamp II Module
- BASIC Stamp Activity Board
- What's a Microcontroller Text and Parts
- 2x16 Serial LCD Module from Scott Edwards Electronics
- LTC1298 12-bit A/D AppKit
- Serial Cable, Power Supply, and CD-ROM

NETCOM (page 25) will continue to provide prizes monthly!

To Subscribe – Just fill in and mail the card supplied in the magazine or call our toll free order line at **(800) 783-4624** with a Visa or MasterCard.

If you do not wish to order a subscription, but would like to be entered in our drawing, simply send or E-Mail your name, address, and telephone number to *Nuts & Volts*, 430 Princeland Ct., Corona, CA 92879 or drawing@nutsvolts.com. No phone entries accepted. All orders/entries must be received by the last day of the month to be included in that particular month's drawing.

A SIMPLE CONTROLLER FOR STEPPER MOTORS

to use with Microprocessors

by
James Lyman

I have some surplus five-volt unipolar stepper motors which I've been wanting to use in robot experiments, but didn't have an easy way to drive them. Then I found just what I've been looking for in my Mar. '98 issue of *Nuts & Volts* magazine.

In the Electronics Q & A was the "Space-age Stepper Motor Controller Update" with a simple schematic which was just what the doctor ordered – except it was for bipolar motors and I had unipolar motors – but after playing with the circuit on Electronics Workbench, I converted the circuit to a unipolar design.

This controller is based on a design from the Jet Propulsion Laboratory and is ideal for use with microprocessors. It has just two control lines: one to control the stepping of the motor and the other to control the direction of the motor's rotation.

Having two common TTL chips (Figure 1), this controller greatly reduces software requirements to drive a stepper motor, as well as reducing the number of port bits by half. With this simple circuit, the microprocessor has only to set an output pin high or low to select the motor's direction of rotation and pulse the other to step the motor. The programmer doesn't need to write code to generate four phase outputs complicated by having to reverse those phases to reverse motor rotation.

Since the rising edge of the motor drive pulse steps the motor, there are no restrictions of duty cycle, so the microprocessor's program only needs to time the overall period, then output a short pulse. This is ideal for using a microprocessor's internal timer to accurately control the motor's rotation speed in background. Changing the direction of motor rotation is done by setting a static output level high or low, so there is no need to synchronize it with the motor drive pulse. The microprocessor's program controls the motor in the foreground while the background program (timer interrupt) actually initiates the change when it outputs the next stepping pulse. The only consideration for changing direction is the motor's inertia during rotation.

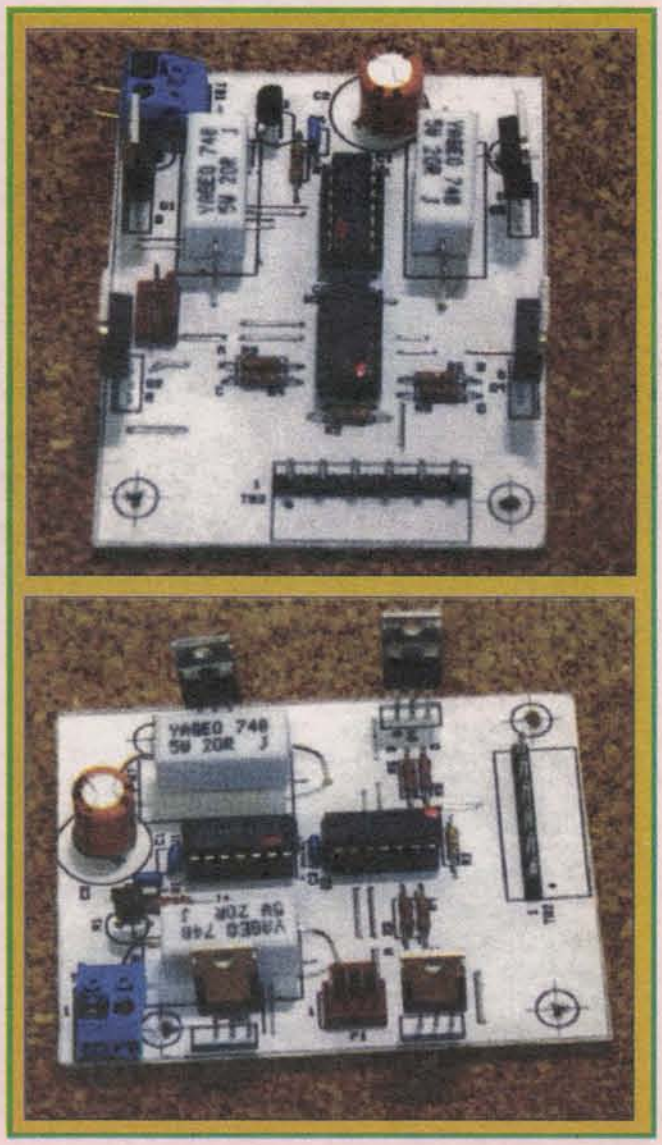
Like most engineers, I naturally look for ways to improve things and this circuit was no exception. I wanted to use this controller with different motor drive voltages and so designed three different ways to provide the +5 volts for the controller's logic circuit.

For motor drive voltages greater than 7.5 volts, the voltage regulator A1 – which regulates the motor drive voltage down to five volts for the logic – is installed along with capacitors C2 and C4. When using a five-volt motor, a jumper wire is installed in place of the voltage regulator as indicated by the line on the board's silkscreen (Figure 2) between A1's outer leads. Both C2 and C4 should still be installed to protect against any voltage transients from the motor's stepping.

If neither A1 or the jumper wire is installed, then the logic voltage is provided directly via the connecting plug P1-2 in which P1 also has the ground and motor control lines. This allows the controller's logic to be connected directly to the power supply of the microprocessor's board.

When this external power option is used, capacitors C2 and C4 are not required and can be omitted. When C2 is installed, its voltage rating should be at least 20% greater than the voltage of the motor's power supply with 50% being preferable. To accommodate a wide range of capacitor voltage ratings for electrolytic capacitor C2, the circuit board has two sets of mounting pads to allow installation of either 5 or 7.5 millimeter lead spacing.

Power for the motor is provided to the controller board via TB1 – a pluggable terminal block where connecting wires are installed in screw terminals, but the terminal block plugs into pins on the circuit board. This allows the circuit board to be quickly removed and installed without disconnecting the wires. This same type of connector is also used to connect the motor to the controller board via terminal block TB2. There is no need to label the motor's six wires each



```
MotorControl:                       ' interrupt service routine
    IF Counter = 0 THEN OutPulse    ' test if end of time interval
    DEC Counter                     ' decrement loop counter
    RETURN                          ' return from interrupt
OutPulse:
    SETBIT OutPort,DriveBit         ' bring motor drive pulse high
    CLRBIT OutPort,DriveBit         ' bring output low to complete pulse
    Counter = StartValue            ' reinitialize counter value
    RETURN                          ' return from interrupt
```

TABLE 1

time you remove the motor from the controller board – something that happens frequently when experimenting with a new design.

The circuit board is a simple single-sided design which allows easy prototyping using the toner transfer system. To facilitate using this method, the board uses oversize circuit lands which are widely spaced to reduce the chance of shorted lands from toner bleed-over. The wide lands also reduce toner lift-up so common when narrow lands are used.

The circuit board layout in Figure 3 can be copied directly to the toner transfer paper. To further increase the toner's adhesion to the blank circuit board, wet sand the copper surface with 400 grit sand paper to give it a uniform buffed appearance, then wash the board first with a soap impregnated steel wool pad and finally with rubbing alcohol to remove any traces of oil. As soon as the board is completely dry, iron on the toner copy of the circuit board, then etch it before the copper can oxidize or be contaminated by finger print oil, either of which will make etching more difficult.

An easy way to "silkscreen" your board is to make a full size copy of the silkscreen artwork and glue it to the top of the circuit board prior to drilling the holes.

FIGURE 2 — Silkscreen for Board

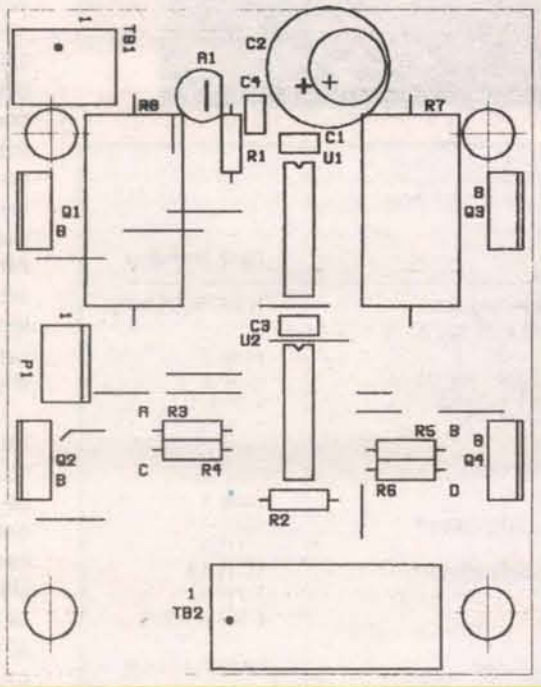
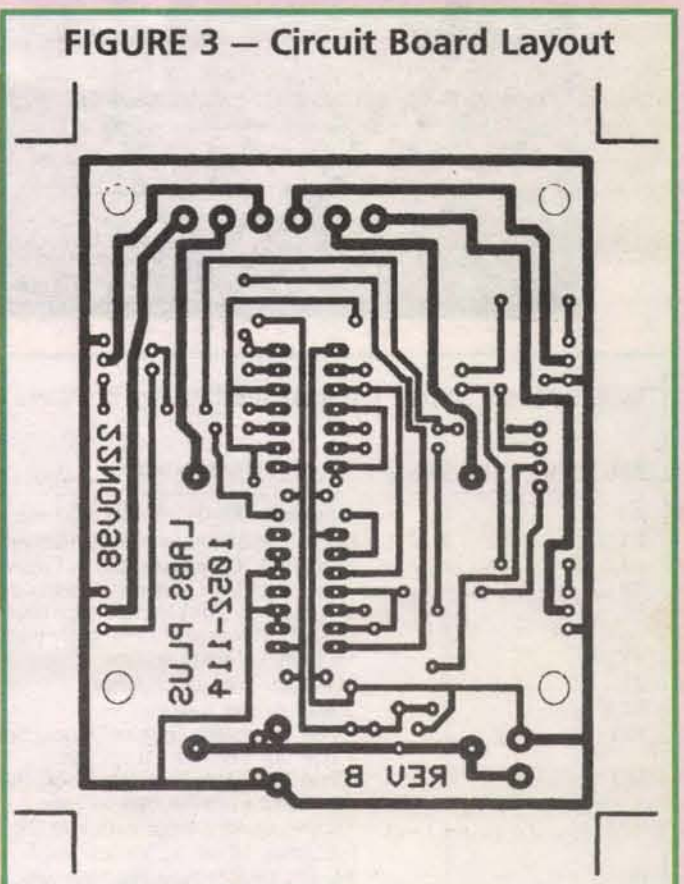


FIGURE 3 — Circuit Board Layout



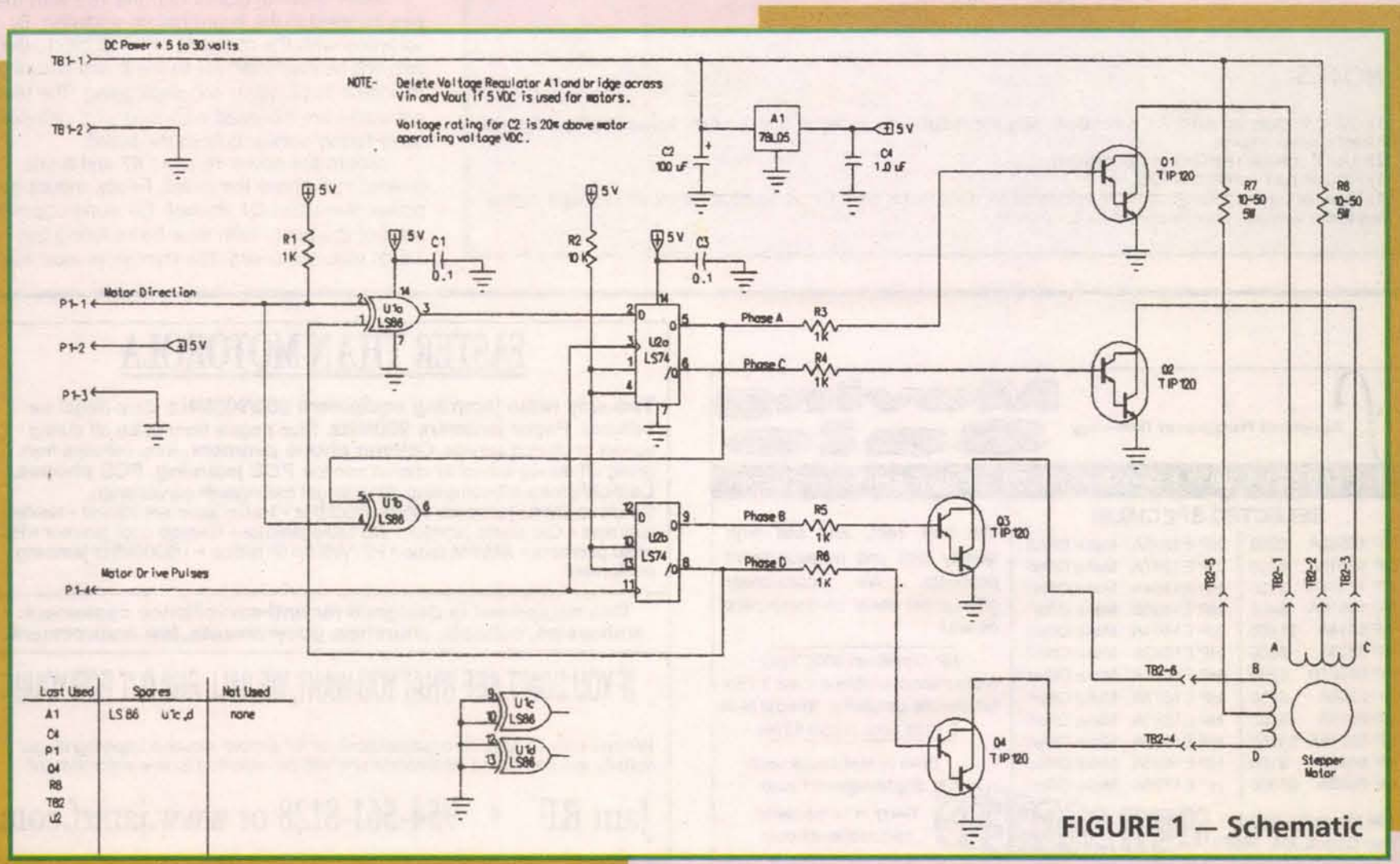
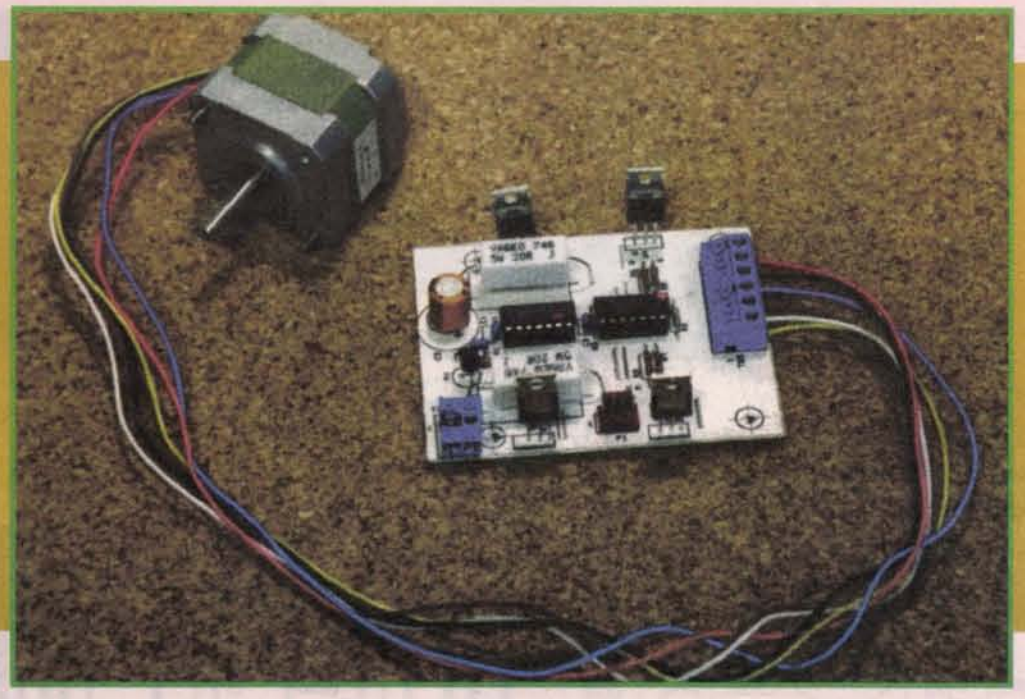


FIGURE 1 — Schematic



Unless noted, all part numbers are Digi-Key numbers

PARTS LIST

Ref. Desg.	Qty.	Nomenclature	Part Number
A1	1	(optional) 78L05 +5 volt, 100 ma, voltage regulator	NJM78L05A
C1,3	2	0.1 uF Capacitor, Monolithic Ceramic, 0.2 inch sp, 25 V	
C2	1	(optional) 100 uF Electrolytic Capacitor	note 1
C4	1	(optional) 1.0 Capacitor, Mono Cer., 0.2 inch sp, 25 V	note 2
P1	1	4 contact straight friction lock header, 0.1 inch sp	WM4202
Q1-4	4	TIP-120 NPN Power Darlington transistor, TO-220	note 3
R1,3-6	5	1K ohm 1/4 watt resistor	
R2	1	10K ohm 1/4 watt resistor	
R7,8	2	5 watt power resistors	note 4
TB1	1	2 Pos. Pluggable Terminal Block, 5m sp., side mount	ED1613
	1	2 pins cut from Pin Header Strip	ED1682
TB2	2	3 Pos. Pluggable Terminal Block, 5m sp., side mount	ED1614
	1	6 pins cut from Pin Header Strip	ED1682
U1	1	74LS86 Quad 2-input Exclusive OR Gate	DM74LS86N
	1	(optional) 14 pin IC Socket, solder tail	
U2	1	74LS74 Dual D Type Flip Flop with Set & Reset	DM74LS74AN
	1	(optional) 14 pin IC Socket, solder tail	
	8in	AWG # 24 Solid Bare Buss Wire	

NOTES:

1) Use if voltage regulator A1 is installed. May use radial lead spacing of 5 or 7.5 mm. Voltage rating is 50% of motor's rated voltage.
2) Use if voltage regulator A1 is installed.
3) Jameco part number 32993.
4) Value of power resistors must be calculated for each motor type. Circuit board accommodates 5 watt outline, but lower wattage may be used if motor permits.

Use a brushable contact or rubber cement such as DAP Weldwood contact cement which can be found in most office supplies and hardware stores. Place the etched circuit board on a light table with its top side up. Now apply a liberal amount of contact cement to the board's top surface, then carefully lower the silkscreen down onto the board's surface. Using a light table or a glass with a light shining up from below allows you to see the circuit board's shadow through the silkscreen and to exactly position it on the board. Remember, for a rectangular circuit board, there are *two* ways for the silkscreen to fit so be sure you have it oriented correctly before starting because once it contacts the glue, you can't peel it up to start over. Now, carefully press the paper of the silkscreen to smooth it out on the board. A small printer's roller works good for this, but you can do it with your fingers if you're careful and work quickly.

After the silkscreen has dried for 15 minutes, take a razor blade and trim the paper flush with the edge of the circuit board. Now turn the board over to drill the pads from the bottom side. To avoid scuffing the silkscreen – particularly if you're using a drill press – place the circuit board on a folded paper towel, which allows you to slide the board around to position under the drill. Although the paper of the silkscreen will "ball up" around the hole, this seldom presents any problem when mounting components. A razor knife can be used to quickly trim any paper that gets in the way.

Since the circuit board is single-sided, it requires 15 jumper wires. These jumpers are well spaced from components so bare buss wire may be used without fear of shorting to other components. The jumper wires are installed first, followed by 1/4-watt resistors, then the capacitors. Unless you are using the five volts for the motor to power the logic, don't install the jumper wire at voltage regulator A1; IC's U1 and U2 can be mounted either directly or in IC sockets.

Insert terminal blocks TB1 and TB2 with their pins installed in the board before soldering. By soldering with the complete terminal block, the pins will be perpendicular to the board ensuring their ease in plugging and unplugging. The terminal blocks are mounted with their wire clamping holes facing outwards from the board.

Mount the power resistors R7 and 8 one quarter inch above the board. Finally, mount the power transistors Q1 through Q4 along opposite sides of the board with their backs facing outwards from the board. The transistors must have

Equipment Management Technology

Moving Sale

Tel 650-631-1700 Fax 650-631-1200 Email sales@emt1.com

SELECTED SPECIALS!

HP 16505A	$250	HP E1345A	Make Offer!
HP 16510A	$100	HP E1347A	Make Offer!
HP 16515A	$100	HP E1364A	Make Offer!
HP 16516A	$400	HP E1400B	Make Offer!
HP 3314A	$1400	HP E1401A	Make Offer!
HP 5335A	$500	HP E1662A	Make Offer!
HP 59501B	$250	HP E1671A	Make Offer!
HP 6266A	$250	HP E1672A	Make Offer!
HP 8016A	$500	HP E1681A	Make Offer!
HP 83545A	$3850	HP E1682A	Make Offer!
HP 8493B	$100	HP E1693A	Make Offer!
HP 8958A	$5000	HP E1725A	Make Offer!

We buy, rent, and sell high quality test and measurement products. We occasionaly offer great deals on computers as well.

HP OmniBook 600C color subnotebook weighs a mere 3.7lbs for ultimate portability. Special Nuts & Volts price is only **$250!**

Dave is test equipment!
Bigdave@emt1.com
Kerry is computers!
kwhite@emt1.com

956 Bransten Road
San Carlos, CA 94070

NEW ADDRESS

FASTER THAN MOTOROLA

Two-way radio jamming equipment 800/900MHz. Stop illegal surveillance. **Pager jammers 900MHz.** Stop pagers from going off during school or church service. **Cellular phone jammers.** Stop cellulars from going off during school or church service. **PCS jamming, PCS phones. Lojack**/teletrack/boomerang. Stop illegal tracing/anti-surveillance. Cordless phone jammers 49MHz/900MHz • Radar jammers Xband • Nextel jammers • Car alarm jammer • CB radio jammer • Garage door jammer • RC radio jammers • AM/FM radio • HF/VHF/UHF radios • 1/8000MHz jamming equipment.

This equipment is designed for anti-surveillance customers: embassies, schools, churches, governments, law enforcement.

IF YOU DON'T SEE WHAT YOU WANT, WE WILL BUILD IT FOR YOU!!

We sell only to specific organizations or for export. Anyone implying illegal activity will be denied assistance and will be reported to law enforcement.

Jam RF • 954-561-8128 or www.jamrf.com

Write in 146 on Reader Service Card.

insulators when using a common metal heatsink or when individual heatsinks are grounded.

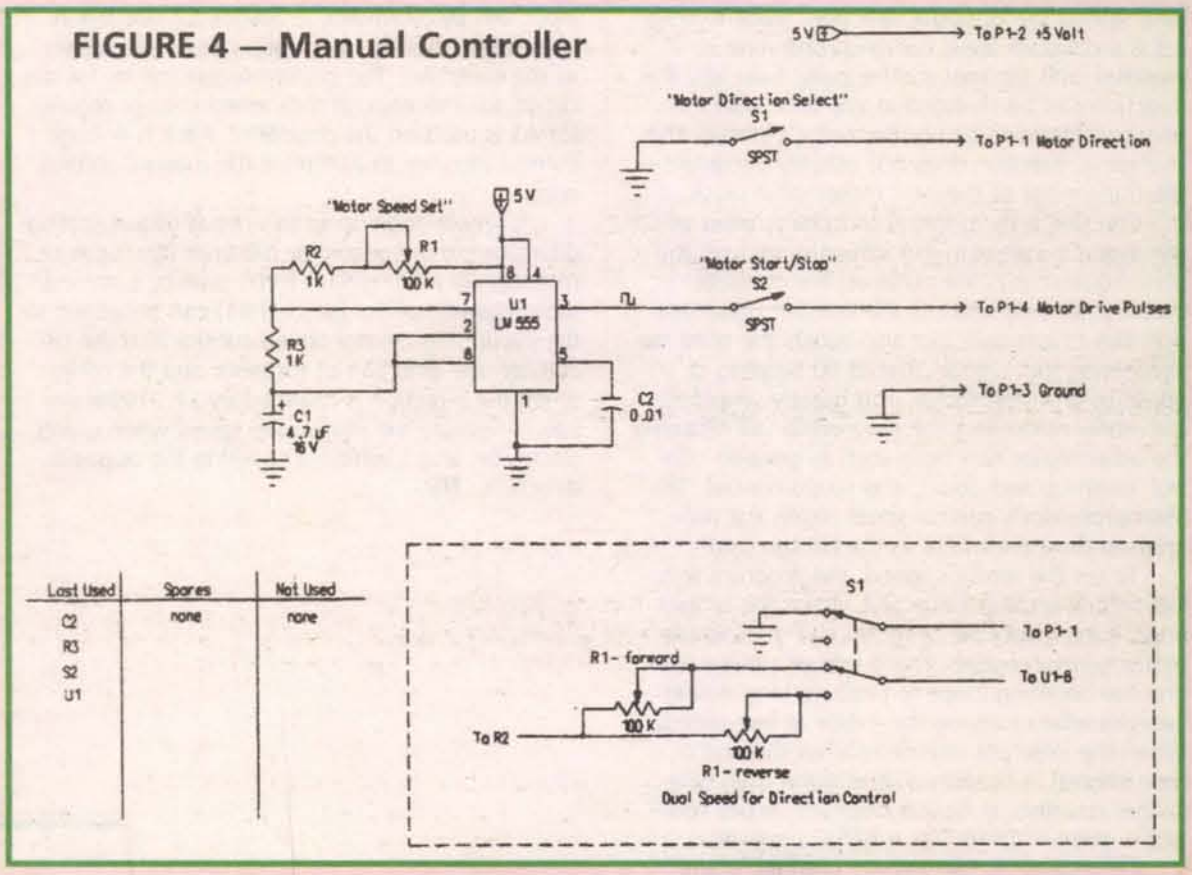
Prior to applying power, use an ohmmeter to test for shorts between power input and ground. Place one probe on terminal block TB1-1, the other on TB1-2, and check if shorted. Now test the five-volt logic supply by placing one probe on pin 14 of either U1 or U2 and the other on pin 7. Do not apply power if you read near zero ohms for either of these tests until the short has been found and removed.

The controller board is connected to a microprocessor's board using a four conductor cable connected to plug P1. Motor drive pulses are applied to P1-4 while the direction control is through P1-1. Ground connection is through P1-3 and, if the logic power is provided by the microprocessor's board, the +5 volts connects to P1-2. Wire size is not critical but, since pulses are present, the cable length should be kept to a minimum. Power for the motor is provided by terminal block TB1 with TB1-1 for the positive voltage input and TB1-2 the negative or ground. Each of the six motor wires connect to terminal block TB2 per the table below.

Coil Phase	Terminal of TB2
A	1
A-C common	2
C	3
D	4
B-D common	5
B	6

Interfacing this controller with a microprocessor is simple from both the hardware and software standpoint. Only two bits of an output port are required to fully control the motor's speed and direction; the only restriction is that both are

FIGURE 4 — Manual Controller



TTL signals. The Motor Drive signal (P1-4) is a positive pulse which "steps" the stepper motor on each positive transition. The microprocessor's motor control program drives the motor by outputting pulses whose spacing is controlled by timing loops or its internal timer. The resulting frequency of this pulse train controls the motor's rotational speed. Changing motor speed is done by simply changing the period of the pulse train. Since a microprocessor can accurately time intervals, and duty cycle is not critical, the motor's speed can be accurately maintained. Even when running the motor at very low speeds, its accuracy is easily maintained.

Selecting direction of motor rotation is done using the Motor Direction (P1-1) input signal with a constant high or low level. A logic high level selects one direction of rotation, while a logic low

ALLTECH ELECTRONICS
WWW.COMPUTERCHOPPER.COM
WE CHOP PRICE$!

SCSI CD ROM
Matsushita / Apple OEM PC or Mac SCSI
4x $19 24x $79

486 Mini System
486SX25 • Great for Linux DX266 Upgradable • 2 ISA Slots • VGA, LPT, 2COMs • FD
$29

250VA Isolation Transformer
115V Pri - 115V 250VA Sec
Magnetek Triad
6" x 4" x 5"

10" Open Frame SVGA
Metal Enclosed - Displays Up to 1024 x 768 • 110V AC
Also Available in a standard case. $129
$119

7 SCSI CD's in a Tower
7 CR-504-L Drives in a SCSI Tower case - 50 Pin
$179

Open Frame
Industrial DC P/S +5/12 -5/12 +24V
$29

24 Bit Flat Bed Scanner
Win95/98 - ImageWave by Storm Technology. Parallel Port Interface Software Included! 5 Minute Installation
$39

LCD Closeout!
Various LCD's - In New Condition - We have no Docs or controllers. See the web. Starting at
$29

9" Mono VGA
Small footprint monitor Great for servers, test benches, etc. 640 x 480 only. Refurbished.
$49

9.75" Mono, 8.6" and 10.4" Color LCDs
Great for Servers: ISA Controller Included!! All screens are 640x480. The controller supports 256 Colors.
9.75" Mono Passive.....$89.00
9.5" Color Passive.....$199.00
10.4" Color Active.....$319.00
Touch Screen Option Available.
See our web site for more details.
$89 & up.

Cheaper Ethernet Stuff
Industrial Surplus
PC Parts • Mac Parts
For more information on these products and hundreds of other products check out:
WWW.ComputerChopper.Com

760/724-2404
Fax 760/724-8808
Computer Circulation Center, Inc.
2618 Temple Heights Drive
Oceanside, CA 92056

Mon-Fri 9AM -5:30PM - Or see us on the internet.
VISA • Mastercard • Discover • American Express
Prices & Availability subject to change without notice • Government & Educational PO's Accepted. • Not Responsible for Typographical Errors

Write in 147 on Reader Service Card.

SAME DAY PROTOS
Modem Gerber files before 9 AM EST.
We ship the boards same day.
Multilayers NEXT DAY.

Service:
- Instant Quotes
- Single / Double / Multi-Layers
- SMOBC and LPI
- Thru Hole or SMT
- Nickel and Gold Plating
- Routing / Scored Panels
- Blind and Buried Vias
- Electrical Testing
- Carbon Ink / Peelable Mask
- UL Approved

CHICAGO CIRCUITS CORPORATION
Manufacturer of Printed Circuit Boards
2685 UNITED LANE
ELK GROVE VILLAGE, IL 60007
E-MAIL: sales@chicagocircuits.com
TEL: (847) 238-1623 • FAX: (847) 238-9160
MODEM: (847) 238-1728

Write in 148 on Reader Service Card.

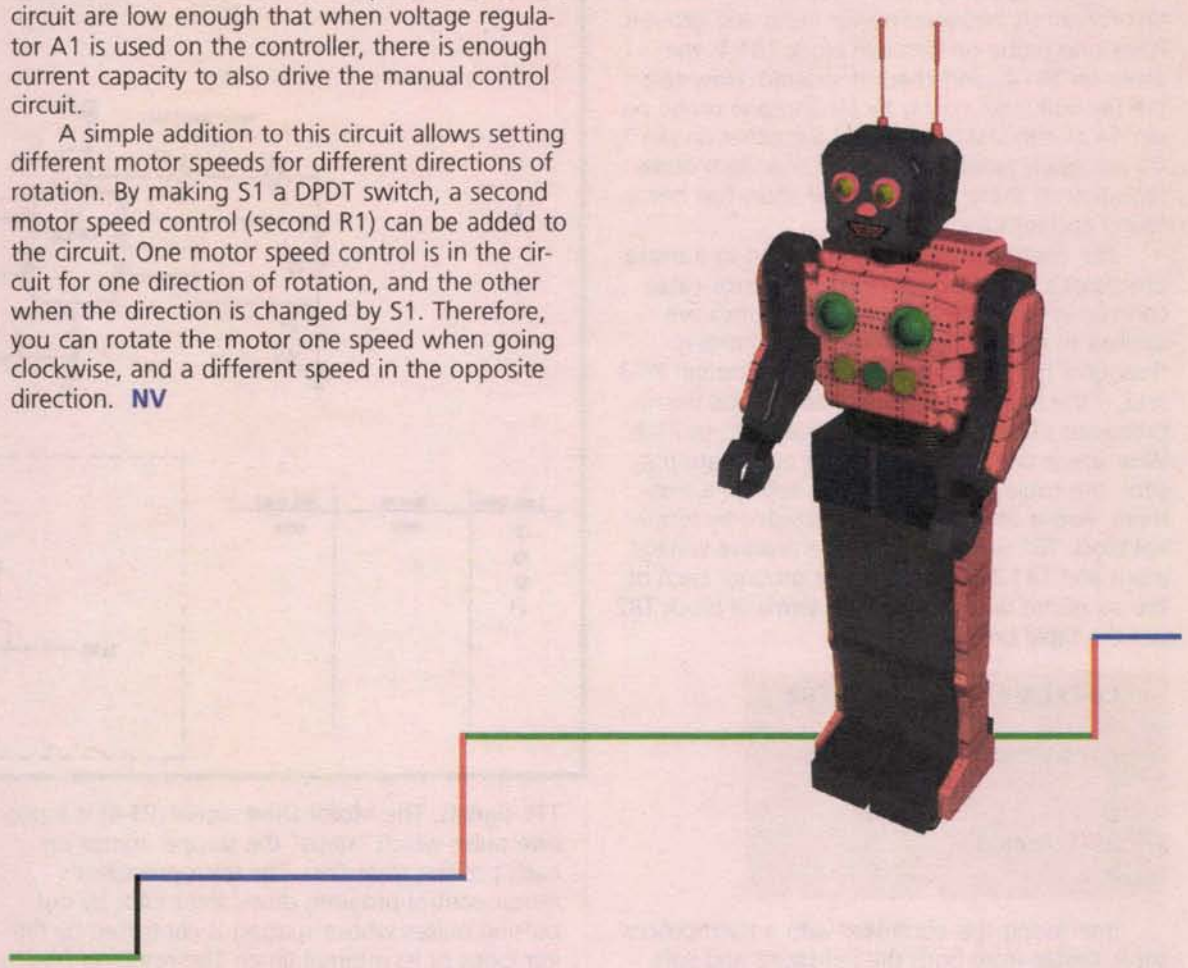
level selects the opposite direction. Since this signal is a constant level, no synchronization is required with the motor drive pulse train and the direction can be changed at any time with the only consideration being the motor's inertia. The change in direction does not actually occur until the rising edge of the next motor drive pulse.

The simplicity of this circuit places most of the motor's control in the software, and yet the port requirements are minimal. The controller's circuitry not only reduces the number of output port bits to just two, but also avoids the need for generating four signals spaced 90 degrees in phase to drive the motor. This greatly simplifies the motor-controlling software while still retaining the other motor functions such as position control, ramp up and down, and speed control. The microprocessor's internal timer allows the program to drive the motor in the background.

To set the motor's speed, the program sets the timer's counter value and, when the timer ends, it interrupts the program and goes to the motor control routine. This interrupt service routine has counting loops to produce long timing intervals when running the motor at low speeds. When the interrupt routine reaches the end of a time interval, it outputs a drive pulse then reinitializes counters. A typical interrupt service routine is given in Table 1 as a BASIC program.

This controller can also be used as "stand alone" by using an external pulse generator. A simple pulse generator (Figure 4) is made with a 555 timer chip U1 in the astable mode which produces a continuous squarewave. Variable resistor R1 is used to vary the oscillator's frequency and hence the motor's speed while the motor's direction is controlled with S1 – an SPST switch to ground. Since the Motor Direction control has a pull-up resistor, switch S1 only needs to pull the input low by grounding it. Switch S2 starts and stops the motor by interrupting the drive pulses to the controller. The current requirements for this circuit are low enough that when voltage regulator A1 is used on the controller, there is enough current capacity to also drive the manual control circuit.

A simple addition to this circuit allows setting different motor speeds for different directions of rotation. By making S1 a DPDT switch, a second motor speed control (second R1) can be added to the circuit. One motor speed control is in the circuit for one direction of rotation, and the other when the direction is changed by S1. Therefore, you can rotate the motor one speed when going clockwise, and a different speed in the opposite direction. **NV**



HOBBYISTS' ELECTRONIC SURPLUS

New Arrivals Daily!

FREE RESISTORS

We also service small & large OEM accounts.
We buy & sell excess electronic inventory.

(408) 573-7045

Check out our website
www.excess-solutions.com

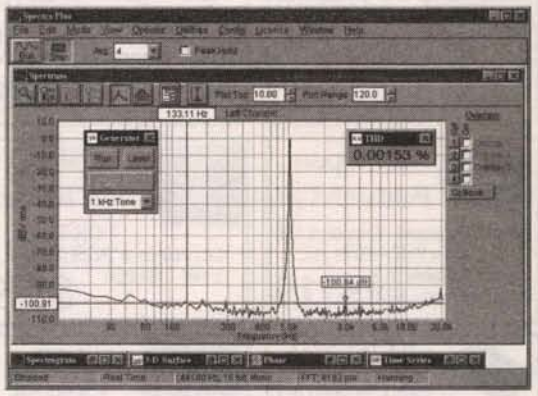
E$ Excess Solutions
Retail Store Location
430 E. Brokaw Rd.
San Jose, CA 95112

Turn Your Multimedia PC into a Powerful Real-Time Audio Spectrum Analyzer

Features
- 20 kHz real-time bandwith
- Fast 32 bit executable
- Dual channel analysis
- High Resolution FFT
- Octave Analysis
- THD, THD+N, SNR measurements
- Signal Generation
- Triggering, Decimation
- Transfer Functions, Coherence
- Time Series, Spectrum Phase, and 3-D Surface plots
- Real-Time Recording and Post-Processing modes

Applications
- Distortion Analysis
- Frequency Response Testing
- Vibration Measurements
- Acoustic Research

System Requirements
- 486 CPU or greater
- 8 MB RAM minimum
- Win. 95, NT, or Win. 3.1 + Win.32s
- Mouse and Math coprocessor
- 16 bit sound card



Priced from $299
(U.S. sales only – not for export/resale)

DOWNLOAD FREE 30 DAY TRIAL!
www.spectraplus.com

PHS Pioneer Hill Software
24460 Mason Rd.
Poulsbo, WA 98370
a subsidiary of Sound Technology, Inc.

Spectra Plus
FFT Spectral Analysis System

Sales: (360) 697-3472 Fax: (360) 697-7717 e-mail: pioneer@telebyte.com

Write in 149 on Reader Service Card.

Write in 150 on Reader Service Card.

Continued from page 41

PICS, GALS READ if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

DTV & DISH NETWORK INFORMATION (33 pages) only $15. Call toll-free 1-877-856-0923. Plus cable television reference guides for all systems, call 1-877-880-0197.

NEW! CABLE converter electronic service equipment and supplies for most cable converter boxes. Highest service, lowest prices. Call Ken Erny Electronics. 24 hr. order and information hot line 516-389-3536.

NOTCH FILTERS 110, 108.5, 106.5, 97.5 75dB deep notch. $19.95 ea., 1-5 qty. $15.95 ea., 6-10 qty. $11.95 ea., 11-20 qty. $9.95 ea., 21 or more qty. Call 24 hr. order and information hot line 516-389-3536.

DISCOUNT CABLE converters, bullet snoopers, all makes and models: Genuine unmodified General Instrument, Jerrold, Tocom, Scientific Atlanta, Zenith, Pioneer, Panasonic and more. Best warranty. Free catalog 1-800-243-0962.

PC BOARD ASSEMBLY. Thru hole only. Small or large quantities OK. Call Network Sales. 616-683-0500.

UNMODIFIED CABLE CONVERTERS. Zenith ST1600, ST1086, ST300, Panasonic 175, 145 vol. & non-vol. Regal RR-92 & RC 83, DP5, DP7, DRZ, 5503 VIP, SA 8580. Guaranteed low prices. Please call for more converters 405-631-1856.

CABLE TV. Unmodified converters DP5 $35; DPBB7 $80; 8500 series $15, etc., good prices over 100 pcs. Minimum 10 pcs. any qty., plus all major brands available. Lowest price new/refurbished/field pulls. Phone: 1-800-929-1549.

CABLE CONVERTERS, DBS, remotes, schematics, etc., free flyer. Smart card socket $5 ea. New Atmel 89C52 $10 ea. Jake 419-385-3100.

PLAIN CONVERTERS: Brand-new, the most reliable in the market today. V-Master 3800 only $75 each, refurbish Panasonic-TZPC-175, $39. Minimum 10-lot, 1 full year warranty, same day shipping. 405-634-1535.

BRAND NEW basic converters, 550MHz w/remote, $19.95 ea. 10 lot min. Call 706-657-4445.

RAW CONVERTERS: We have the best quality to your cable needs. PIO-5135 $45; Zenith ST-1600 $75; S/A 8590 (10-B) $65 each; S/A 8590 (11-B) $75 each; Comto 5503 VIP (450 MHz) $35 each; Comto 5503-A only $2 each. Call for others not listed. 405-631-5153.

CABLE CONVERTERS. Original equipment with remote. Like new, ready to go. Lowest prices. Guaranteed. Limited models. Call now 412-833-0773.

THE BEST is back to stay. Master code recovery. 16c5x, 16c62x, PALS, GALS, other microcontrollers, etc. Check out our web page at www.acdinc.com for details or call 703-764-5361 or write Advanced Circuit Designs, Inc., 5765-F Burke Centre Parkway, Suite 317, Burke, VA 22015.

NEW GENUINE unmodified Jerrold DP-7113, $50 ea. 1-800-804-8655.

POSITIVE NOTCH FILTERS. All channels available. Starting at $16 each. Order by single channel #. Top quality non-tunable metal cylinder type. 75dB deep on the notch. Need to block the video on a cable channel? Order a negative notch filter. We carry a large stock on all channels for dealers and vendors. VISA, MASTERCARD, DISCOVER, and UPS COD for established customers. Quantity pricing on 5 or more. 100 pcs. $7 each. Open 8am to 5pm CST, Monday-Friday. All sales must comply with FCC 1996 Cable Act. On the web go to **WWW.GOFILTERS.COM "THE FILTER COMPANY."** Call for all orders **1-800-235-8080.**

ATTN. DEALERS: New 125 channel VM-3800 converter, $75; Centurion CF-3000 true 99 channel, $55; also RAW Zenith 1600, $65; Pioneer BA-6110, $59. Lowest price guaranteed, minimum 10-lot. 405-692-4982.

TOCOM UNMODIFIED 5503 cable converters, untouched, $6 ea. 10 lot min. Call 706-657-4445.

CABLE BROKERS IS HAVING ITS FINAL BLOWOUT OF THEIR WAREHOUSE. THE FOLLOWING UNMODIFIED EQUIPMENT IS AVAILABLE TO OTHER BROKERS AND CABLE COMPANIES IN 100 LOT. ZENITH ST 1083-5, $5; DUAL CABLE INPUT, ST 1600 99 CHANNEL DC BLACK-MIX, $30; TOCOM 5503A $2, VIP $18, 07 $25, PI 5135, $60, V5S8 $50, 2014 $70, 8600 8590, 8570, $30. YOU MUST PREPAY SHIPPING ON ALL ORDERS, $175. CALL 1-800-219-8618.

UNMODIFIED CABLE converters. SA 8590, $39.95 ea. 10 lot min. Call 706-657-4445.

CABLE TV. Join us on the **INTERNET** to buy and sell cable TV equipment, electronic equipment, DSS equipment, satellite equipment, telephony equipment, and much more. Major equipment dealers and wholesalers online. Auctions, classified ads, discussion forums, chat rooms, and dealer links for all types of equipment. Dealers and vendors call or visit our site for ad rates and links. **WWW.GOCABLETV.COM** or call **1-800-451-0083.**

C and H SALES COMPANY

2176 E. Colorado Blvd. • Pasadena, CA 91107

TOLL FREE: 1-800-325-9465

FREE 148 PAGE CATALOG!

C & H SALES COMPANY HAS BEEN IN BUSINESS FOR OVER FIFTY YEARS. WE'RE THE BEST SOURCE FOR GREAT BUYS ON ITEMS LIKE THESE - AND MORE!

ELECTRONIC COUNTER
HEWLETT PACKARD, Model 5328A. Universal counter. Usable to 100 MHz, 100 ns single shot resolution. Has frequency, period, period average, ratio, totalize, scale functions. A built-in digital voltmeter allows measurements of input voltages. Two input channels provide individual slope, polarity and level settings. Has 9 digit LED readout. Input power 100–240 VAC 48–66 Hz 100 VA max. Dimensions: 17" wide x 17-1/4" deep x 3-1/2" high.

Stock #TE9808 **$250.00**

MILLIOHMETER
HEWLETT PACKARD, Model 4328A. Designed to measure very low resistances. Measurement range 1m ohm to 100 ohms. Resolution 20 u ohms. Analog meter readout. Ideal for measuring contact resistance of switches or relays. This unit is also useful for measuring the resistivity of semiconductor devices. (Requires special 4 terminal probes which are not supplied, but probably are available from Hewlett Packard.) Power input: 115–230 VAC 48–66 Hz, 5 VA max. Dimensions: 5-1/8" wide x 11-1/2" deep x 6-1/2" high.

Stock #TE9812 **$200.00**

SOLA CONSTANT VOLTAGE TRANSFORMER
SOLA ELECTRIC, #93-13-150. Harmonically neutralized constant voltage transformer. Rated at 500 watts. Input voltage 95 to 130 VAC 60 Hz. Output voltage 120 VAC. This unit is designed for rack or bench mounting. The meters on the front panel indicate output current and input/output voltage. A toggle switch is provided for selection of input or output voltage. The input voltage is connected at the rear of the unit via a covered electrical panel. Two standard 3-wire grounded electrical outputs are supplied on the front and rear panels. Dimensions: 19" wide x 14-1/4" high x 10-1/4" deep. Weight 59 lbs.
Stock #STR9900 **$225.00**

ALTIMETER/BAROMETER
KOLLSMAN, #MC-2 MS28074-2. Scale type altimeter with barometric setting scale window. Altimeter scale range –1000 to 80,000 feet. Barometric range 28.1 to 31.0 inch of mercury. An adjustment knob is provided for scale setting to local altitude or barometric pressure. Has white numerals on a black background. Illumination is provided. Electrical input is rated 115 VAC 400 cycles. Pressure input port is female 7/16"X20 thread. Standard aircraft panel 3-1/8" mount. Dimensions: 2-17/64" sq. x 7-1/2" deep.

Stock #STOCK #IN9900 **$79.50**

☑ Master Charge ☑ Visa ☑ American Express ☑ Discover

Call us first if you have surplus inventories of electronic, optical, or mechanical items for disposal

WE BUY & SELL!

Write in 41 on Reader Service Card.

BOB SAVED THE WORLD TODAY...

Bob, Super-Tech extrodinaire, has a secret weapon. This amazing device allowed him to locate and replace all 34 bad electrolytic capacitors in this TV in less than 30 minutes. So instead of throwing this TV into the local landfill and adding more pollution, Bob's secret weapon enabled him to give the World a brighter future. Impressed his manager and his customer too.
Bob's secret weapon? The world's best in-circuit cap checker, the ***CapAnalyzer 88A*** by **EDS**.

Smart techs know that to be productive you need to find defective components quickly and accurately. That's why General Motors, Matsushita Industrial, Sears Service, Pioneer Electronics, Panasonic Authorized Service, NASA/Kennedy Space Center, Time/Warner Communications, NBC TV and thousands more independent service technicians have chosen the ***CapAnalyzer 88A*** over all of the other capacitor checkers. Check www.eds-inc.com/88users.html for actual ***CapAnalyzer*** users' comments as they compare their ***CapAnalyzer*** to the "wizards" and "z-meters" they already own. They all prefer the ***CapAnalyzer*** because it checks electrolytic capacitors, *in-circuit*, with 100% accuracy. No unsoldering to check out-of-circuit, no mistaking a shorted or leaky cap as good, as other "ESR" meters do, no guessing about whether a value is good or bad. With our exclusive three-color comparison chart right on the front panel, auto-discharge, multi-beep alert, and one-handed tweezer test probe, even your pet monkey could find defective caps in that problem PWM power supply, TV, monitor or VCR in a few seconds.

...NOW IT'S YOUR TURN.

So get your own ***CapAnalyzer 88A***. It's only $179. With our exclusive 60-day satisfaction-or-money-back guarantee, you risk nothing. Prepare to be amazed: your only problem will be running out of work as you take care of all of those "dogs" that you've been sitting on. We're **Electronic Design Specialists**. We make test equipment designed to make you money. Available at your distributor now, or call 561-487-6103. Check out **www.eds-inc.com** for the details.

Write in 40 on Reader Service Card.

ZENITH UNMODIFIED converters. ST 1000-288, $16 ea. 10 lot min., ST 1086, $25 ea. 10 lot min., ST 1600, $59.95 ea. 10 lot min. Call 706-657-4445.

PLAYSTATION MOD chips. New Dino mode program. Works with all models up to 900x. Color instructions. Seven wire hook up, does not come with wires. $5 each, plus shipping charges. 10% discount for 10 or more. Call 703-764-5118 to place an order.

CABLE PARTS & EVERYTHING. Best prices & quantity discounts. WE DON'T SELL BOXES. 1-800-MODULE-0.

SONY PLAYSTATION MODCHIPS. Allows playing of CDR backups & imports. $10 + $3 shipping. 619-590-9320.

CABLE PARTS! Computer parts. Call for great prices or visit us on the Web: HTTP://WWW.CB-Electronics.com or call 1-800-436-8630.

THE WIZARD SAYS check out our prices. Cable parts & raw boxes. 1-888-79-chips. **www.chipwizards.com**

CABLE PARTS for all makes and models, raw boxes at low prices. Call 1-888-817-8100 www.chipplace.com

TELEPHONE/FAX

12 HOUR fully automatic heavy duty professional **TELEPHONE RECORDER, $79** including shipping. Send check or money order to: **VAKIS**, 1402 Pine Ave., Niagara Falls, NY 14301.

PHONE SYSTEMS WANTED!!! We buy AT&T MERLIN, SYSTEM 25/75/85 and other AT&T phone systems. Please call for a quote or fax us your equipment list. **KEYWAYS, INC.**, 937-847-2300 or FAX 937-847-2350.

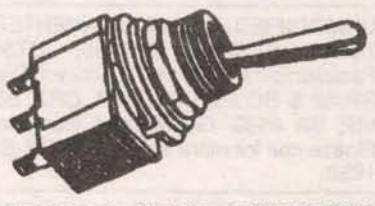
CABLE TV. Join us on the **INTERNET** to buy and sell cable TV equipment, electronic equipment, DSS equipment, satellite equipment, telephony equipment, and much more. Major equipment dealers and wholesalers online. Auctions, classified ads, discussion forums, chat rooms, and dealer links for all types of equipment. Dealers and vendors call or visit our site for ad rates and links. **WWW.GOCABLETV.COM** or call **1-800-451-0083.**

LOOKING FOR programming and instruction books for Executone KSU model 7884, with model 82600-4 phones. E-Mail to kryvanick@internet8.net or call 504-876-2229.

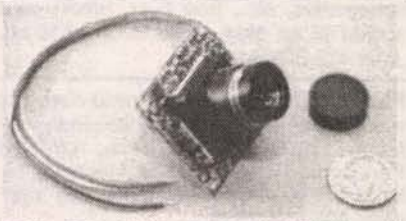
COMPONENTS

RF TRANSISTORS, TUBES, SD1446, MRF455, MRF454, 2SC2290, 2SC1969, 2SC2166, 2SB754, TA7222AP, 2SC1947, TIP42C, KIA7217, MRF422, MRF448, MRF247, MRF317, SAV7, SAV17, 3-500ZG, 4CX250B, 572B, 3CX400A7/8874, 3CX3000A7, 4CX400A, silver mica caps, resistors, electrolytics, etc. Westgate 1-800-213-4563.

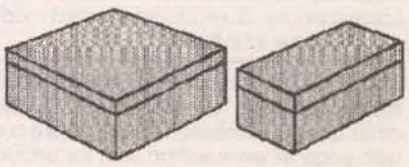
WANT TO Buy: ICs, military & aircraft relays, diodes, transistors, Cannon, TRW, Amp, Burndy, Deutsch, Bendix connectors, electronic test equipment & most components. Hoffy Electronic Ent., 818-718-1165, FAX 818-341-5506. E-Mail: Hoffie1165@aol.com



AMAZING! 35¢ ALL TOGGLE SWITCHES. Brand new. Rated 6A/125V. Hardware included. 1/4" panel hole. SPDT or DPDT on-on, or on-off-on. Minimum 100pcs./package. Add $6 freight. Gateway Products Corporation, PO Box 936397, Margate, FL 33093, 954-227-9300. VISA/MC, no COD.



B/W 430 LINE CCD CAMERA with optional black low-profile swivel adjustable enclosure. Pin hole or Std. lens type. 6, 8, and 12mm lens are available. 1/3" CCD, 3.6mm/F2.0 lens included; 9-14 VDC, 0.08 lux, IR sensitive; 1.27" x 1.27" x 0.5"D pinhole or 1" deep standard. Price @ 10 pcs., **$44 each.** Enclosure: $8; optional lens: $18. Dealers welcome. MATCO, Inc. 1-800-719-9605. Fax 847-619-0852. E-Mail: sales@mat-co.com Website: www.mat-co.com



POCKET MINI-BOXES: Small plastic boxes. High quality, LOW COST! Low as $0.49. Attention manufacturers! Great for products! 805-339-0702. **www.ElectronicsUSA.com**

ALL ELECTRONICS CORPORATION

QUALITY Parts
FAST Shipping
DISCOUNT Pricing

CALL, WRITE, FAX or E-MAIL For A Free 96 Page CATALOG. Outside the U.S.A. send $3.00 postage.

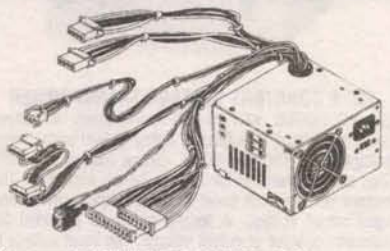
SPECIAL - 12 Vdc 1 Amp Power Supply

New 12 Vdc, 1 Amp table top power supply. 3.4" x 2.8" x 2.3" high. 6' two conductor AC power cord. 6' 18/2 output power cord with strip-ped and tinned ends. Output is 16 Vdc with no load, 12 Vdc with 1 Amp load. Supplies are new but have no labels or markings. **CAT # DCTX-1213**

10 for $50.00
100 for $400.00

$5.50 each

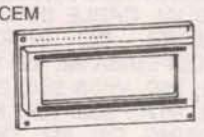
REDUCED PRICE! 185 Watt Power Supply



Compaq # 172417-002 (172432-001)
Input: 120/ 240 Vac (switchable)
DC outputs: +5V @ 18A, +3.4V @ 12A, +12V @ 6A, -5V @ 0.15A,-12V @ 0.15A.
Size: 6.5" x 5.75" x 3.85" Built-in fan. On/off switch on 20" lead. Power cord not included. UL, CSA.

CAT # PS-185 $7.50 each

20 Character X 4 Line LCD



Optrex # DMC 20434-CEM
(PWB 20434-CEM)
5 x 8 dot format.
3" x 1" viewing area.
3.88" x 2.38" module.
Removed from new equipment. May have felt padding on metal bezel. 14 pin single row header is pre-attached. Spec/hook-up sheet included.

CAT# LCD-46 $7.00 each

10 for $60.00

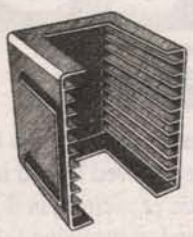
Snap-In Capacitor

560 UF 400 Vdc - NICHICON CE 85° C LQ (M). 1.39" dia. X 1.83"h. 0.4" lead sp. **CAT# EC-5640**

10 for $3.75 each
100 for $3.00 each

$4.00 each

Modular CD Racks



Organize your CDs or CD ROMs with these high-impact, black plastic CD storage racks. Slots for 12 jewel cases. Each 12 CD module can interlock vertically and horizontally with other modules. Can be free-standing or wall mounted.

CAT# CDR-3 $2.00 each

10 for $17.50

40 RPM Gearhead Motor

Pittman # GM8212C127-R2. Small, powerful gearhead motor. 187:1 ratio. No load specs: 40 RPM @ 19.1 Vdc, 130 mA. 24 RPM @ 12 Vdc, 160 mA. Overall dimensions 3" long X 1.37" diameter. 0.185" (3/16") diameter X 0.75" long shaft. A brass 0.56" diameter gear with 16 cogs is fastened to the shaft. 17" leads.

CAT# DCM-135 $15.00 each

10 for $125.00

Cordless Phone Battery Pack

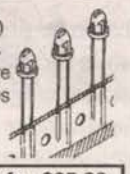
Sanyo # 3N-270AA. Popular rechargeable nickel-cadmium battery pack for cordless phones. Three 2/3 AA cells with connector to fit many phones made by Cobra, Code-a-phone, General Electric, GTE and Sanyo. 3.6 Volt, 270 mAh. Pack size, 1.68" x 1.23" x 0.58". Large quantity available.

CAT # NCB-23AA

$2.00 each

10 for $17.50
100 for $110.00

3000 MCD ULTRA-BRIGHT RED LED



Everlight # 383URC-2/TR1-C(R) Red, "Ultra-bright" T 1 3/4 LEDs "Tape-and-reel" parts. These are 5 mm diameter water-clear LEDs that light bright red at 20 ma.

CAT# LED-50

2 for $1.00

100 for $35.00
1000 for $250.00

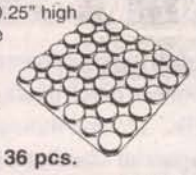
S-VHS Video Tapes (Used)

Super VHS tape users! Save a bundle on name-brand S-VHS, T-120 tapes. These tapes were used for a brief period, then bulk erased. The record-protect tabs have been broken out, so you will have to cover the notch with a piece of tape, but they work great .

CAT # S-VHS $3.00 each

10 for $28.00 • 100 for $250.00

3/4" Protective Pads



Self-sticking 0.8" dia x 0.25" high black rubber discs. Use as feet, spacers, cushions and protectors. Packaged 36 per sheet.

CAT # RF-341

Minimum purchase 36 pcs.

360 for $18.00

36 for $3.60

ORDER TOLL FREE **1-800-826-5432**
Shop ON-LINE www.allelectronics.com

MAIL ORDERS TO:
ALL ELECTRONICS CORP.
P.O. BOX 567 • VAN NUYS, CA 91408-0567

FAX (818) 781-2653 • INFO (818) 904-0524
E-MAIL allcorp@allcorp.com

NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard, American Express or Discover • Checks and Money Orders Accepted by Mail • Orders Delivered in the State of California must include California State Sales Tax • NO C.O.D • Shipping and Handling $5.00 for the 48 Continental United States - ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write, E-MAIL or Fax YOUR LIST.

Write in 42 on Reader Service Card.

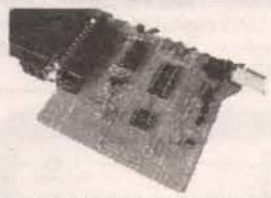
ICs FOR EXPERIMENTERS: Elm offers a variety of ICs for home security, infrared, Control L, as well as basic timing, switch debouncing, etc. Secure purchasing on the web at **www.elmelectronics.com**

SEE OUR ad on 4-channel 2.4GHz wireless system in the AdMart section on page 69. Matco, Inc.

SMD MICRO INDUCTORS: wire wound on ceramic core. Values from 5 to 90 Nhenries tolerances from 5 to 20%. Types 0603, 0805, 1008SMD. Bulk and reel. 40 million open to offers! 760-736-4411.

GLASS KLEIN BOTTLES, $25 to $40. One sided, zero volume, boundary free, Pyrex manifolds. Acme Klein Bottle, 6270 Colby, Oakland, CA 94618. www.kleinbottle.com

MICROCONTROLLERS



PIC MICROCONTROLLER PROGRAMMER KIT. Super value at $19.95 + $4.95 shipping. See our web site for the complete range of PICs that can be programmed. Includes PCB, parts and instructions. P16PRO shareware must be downloaded from the web. Amazon Electronics, tel 1-888-549-3749. Lots of other products. **www.electronics123.com**

STAMP BOOSTER: Output cards connect to BASIC Stamp, other micros, via serial output. Provide 16 or 32 highside, lowside, or bridged outputs, up to 4 amps total. Output timed pulses to 255 seconds, blinking, flashing, PWM, more, on 32 outputs SIMULTANEOUSLY. Addressable, hundreds of outputs from one pin! Oak Tree Systems, 3922 Valentine Rd., Whitmore Lake, MI 48189. www.oaktreesystems.com

ANTIQUE ELECTRONICS

WESTERN ELECTRIC wanted: 1920s-1960s. Amplifiers, mixers, pre-amps, speakers, tubes, etc. FREE OFFER 1-800-251-5454.

WANTED: FOR historical museum, pre-1980 microcomputers, magazines, and sales literature. Floyd, VA 24091-0341 (540-763-3311/540-382-2935).

CRYSTAL SETS. Parts, plans, books, kits. Largest source in the world. Catalog $2. B. TURKE, PO Box 222288, Hollywood, FL 33022.

RADIO TUBES and phono. needles. 870-347-2281.

AVIATION ELECTRONICS

PRIMECELL

IF YOU NEED NEW BATTERIES FOR YOUR ELECTRONIC EQUIPMENT DON'T PITCH EM' - SEND THEM FOR REBUILDING ! - SAVE $ $

CUNARD ASSOC. INC., 9343 US RT 220, Bedford, PA 15522

- *WE INSTALL NEW NI-CAD OR NI-MH BATTERIES INTO YOUR ORIGINAL CASE.*
- *WE IMPROVE CAPACITY TO BETTER THAN ORIGINAL.*
- *WE FIX WHAT CAN'T BE FOUND. (OR AFFORDED)*
- *WE PROVIDE QUICK SERVICE. / EXTENDED LIFE FOR OLDER EQUIPMENT*
- *WE OFFER FREE QUOTES. / FREE RETURN IF QUOTE IS REFUSED.*
- *WE PROPERLY DISPOSE OF YOUR OLD CELLS BY RECYCLING.*
- *WE GIVE YOU A 12 MONTH WARRANTY.*
- *WE WILL BE HERE WHEN YOU NEED US / EST. 1986*
- *WE SAVE YOU **** M O N E Y **** $ $ $ $*

- *NO JOB IS TOO LARGE OR TOO SMALL ..... VOLUME DISCOUNTS AVAILABLE*

GENERAL ELECTRIC		UNIDEN		RADIO SHACK	
19A704850P(1200mAH)	$ 34.95	APX550 1050	$ 29.95	HTX Packs	$ 29.95
19A704860P(1800mAH)	$ 39.95	1000 1010 1070	$ 34.95	New 8.4V pack & chgr	
PL19D429763(777)G1/3	$ 37.95	1100 1200 Series	$ 36.95	1500mAh nimh	$ 34.95
19A705293P 344A4506P	$ 34.95	BP205 650mAh	$ 19.95	KENWOOD	
MAXON SA-1155 1160	$ 39.95	BP200 1500mAh	$ 24.95	PB2 / KNB3	$ 29.95
TAD 1450 1510 1520	$ 21.95	SC150 1500mAh	$ 22.95	PB21/21H	$ 14.95
MOTOROLA		ICOM		PB25/H/26	$ 24.95
P200 HT600 MT1000		BP2 / BP3 /BP22	$ 18.95	CORDLESS DRILLS	
NTN 4585 4824 5414	$ 37.95	BP5 / BP23 / 24	$ 24.95	Any brand 7.2V	$ 18.95
NTN 5447 5521 5545	$ 37.95	BP7 / CM7/ BP8	$ 32.95	Any brand 9.6V	$ 29.95
NLN 5860 NTN 4327	$ 39.95	BP180 / CM79	$ 34.95	Any brand 12.0V	$ 32.95
MIDLAND		YAESU		Any brand 14.4V	$ 37.95
70-B10 B16 B19 B21	$ 39.95	FNB 3 4 12 14 16	$ 32.95	Any Brand 18.0V	$ 45.95
B25 B26 B32 B36 B60	$ 39.95	FNB19 21 26 27 38	$ 32.95	COMPUTER PACKS	
		FNB 10 1117 25 35	$ 23.95	Send battery for quote.	

FOR INFORMATION ABOUT YOUR REQUIREMENTS ..... CONTACT US:
PHONE OR FAX : (814) 623-7000 E-MAIL TO: PRIMECELL @ AOL.COM
SEND YOUR PACKS FOR FREE QUOTATION VIA UPS, RPS OR US MAIL
VISIT OUR WEB SITE http://members.aol.com/primecell/primecell.htm

BATTERY REBUILD SERVICE

MANY OTHERS AVAILABLE - WRITE OR CALL
FREE CATALOG
ADD $ 4.50 SHIPPING & HANDLING PER ORDER

Master Card VISA

Write in 43 on Reader Service Card.

COMPUTER PARTS

NEW ARRIVAL! Super Deal on new Pentium II PC System-Fully Y2K Compliant.

BAREBONES SYSTEM **$245**

Mainboard + ATX case, 56K V.90 Fax/Modem, 8MB AGP Video, 3D sound, 10/100 network adapter, removable hard drive kit, floppy drive, speakers,keyboard, and mouse. (CPU, memory, & hard drive not included...available below.)

Memory		Other Add-ons	
SDRAM PC-100 32MB/64MB	CALL	40x CD-ROM	$39
128MB/256MB	CALL	4.3 GB Hard Drive	$95
Packard Bell Upgrades		8.4 GB Hard Drive	$124
VIDEO: 512K Kit	$18	10.8 GB Hard Drive	$149
1MB Kit	$49	**Processors**	
CACHE: 128K Kit	$18	Intel Celeron 400/500 MHZ	$89/195
512K Kit	$49	Intel PII 400/450 MHZ	$209/230
CPU: Intel 486 DX2-66	$25	Intel PIII 500 MHZ	$290
Intel Pentium Overdrive	$59		

NOTE: Prices subject to change without notice.

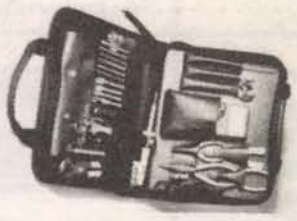
LA PAZ ELECTRONICS INTERNATIONAL
P.O. Box 261095 San Diego CA 92196
Tel. 858.586.7610 * Fax. 858.586.1482

Order Line: 800.586.4199 Visit Our Website @ www.lapazelectronics.com

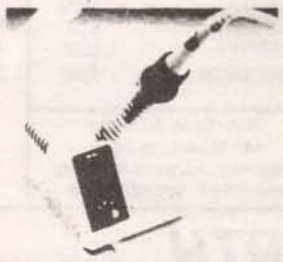
Write in 44 on Reader Service Card.

FOR THE BEST PRICES ON PROFESSIONAL TOOLS, CALL ELECTRO-TOOL

platt – Case – Deluxe Polypropylene. Chemical Resistant. Tools by CooperTools and others. 800T Case, complete with tools . . . **$419.95**
800T Case Only . . . **$121.80**

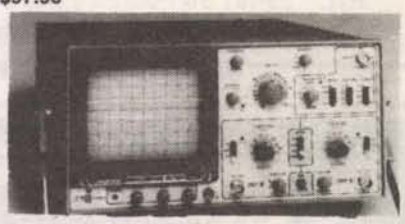


platt – Case – Cordura Exterior. Two exterior pockets & one literature pocket. 660ZT Case, complete with tools . . . **$223.00**
660ZT Case Only . . . **$59.45**
Optional Sperry meter #DM6510 as shown . . . **$65.00**



Weller WCC100- Electronically controlled station, temperature adjustable from 350°F-850°F, Zero voltage circuit-safe for sensitive components, 40 Watt pencil . . . **$97.90**

***Opti*VISOR** – Superior magnification, Optical Glass Prismatic lenses (not plastic). Select any one of (6) magnifications . . . **$24.00**



GoldStar – 20 MHz Dual Trace Oscilloscope OS-9020A-Large 6" rectangular, high sensitivity: 1mV/div,.high accuracy: ±3%, stable, low-drift design, 8 divisions of displayed dynamic range and accurate, distortion-free waveform measurements . . . **$372.00**

Electro Tool, Inc.

VISA
9103 Gillman, Livonia, MI 48150
Customer Service: (734) 422-1221
ORDERS ONLY: 1 (800) 772-3455
FAX: (734) 422-3432
MasterCard
"Tools American Made."

PUBLICATIONS

SECRETS OF RF CIRCUIT DESIGN From Joseph Carr, one of today's most respected electronics authors, comes this pragmatic, intermediate-level guide to designing, building, and testing all types of radio frequency circuits. Filled with functional projects that demonstrate the principles of RF circuits. Only $29.95! **10% discount to *Nuts & Volts* subscribers**. Call 1-**800-783-4624** to order using Visa or MasterCard.

WEBBOOKS OFFERS discount prices on technical/engineering books plus free assistance to authors. Please visit us at http://webbooks.net

NEW SURVIVAL COMMUNICATIONS BOOK. How to build complete home communications systems. Covers all needs: shortwave radio, amateur radio, citizens band, scanners, federal, weather, alternate news, satellite radio, equipment sources. How to build and use alternate emergency power sources, solar, generators, backup batteries. 200 pages. $24 Fast delivery Priority Mail. MC or Visa. Call Universal Electronics 1-800-241-8171.

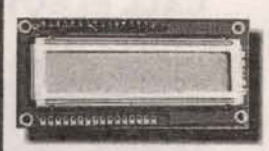
OUT-OF-PRINT TECHNICAL BOOKS. www.johnsontechnicalbooks.com 805-525-8955. **sales@johnsontechnicalbooks.com**

Looking for a great value? Subscriptions to Nuts & Volts are only $19 for a full year. Call *Toll Free* and use your Visa or MasterCard to order! 1-800-783-4624

LOWEST COST LCD'S ON EARTH

VIDEO LCD

4 Inch Video NTSC $150
Sharp P/N 4LU4E
Composite NTSC & RGB Input
12:00 OR 6:00 Viewing Angle
Integrated Backlight & Inverter
Extended Temp: -10 to + 60 C
Brightness: 260 nits
Power Consumption: 4.3 Watts
Contrast: 50 to 1



CHARACTER LCD

OPTREX DMF-5005SN-EW
240 x 64 Graphic EL Backlit STN $30
OPTREX DMF-5005N
240 x 64 Graphic Reflective STN $30
SANYO DM2023-7G1
2 x 20 Character Reflective STN $8
SHARP LM20A21
2 x 20 Character Reflective STN $8
VIKAY 2035TNLD NOTW-D
2 X 16 Character LED Backlit STN $8

LCD MONITOR

10.4" DSTN or 12.1" TFT
Analog SVGA Input
Autosync
Auto Sizeing
Automatic Expansion of VGA images to SVGA (On 12.1")
Very Aggressive Pricing
Starting under $500!

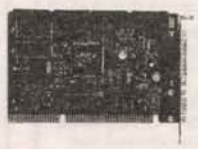
TOUCH MONITOR

EarthVue 10.4
10.4" VGA TFT
Analog VGA Input
105 Nit Brightness
RS-232 Touch Screen Option
Only 9.9"W x 7.7"H x 1.5"D
Ideal For Factory Automation
Fully Articulating Ball Mount
Only $1095 With Touch

LCD DISPLAYS

6.3" Mono STN	$60
9.4" Mono Reflective	$60
8.4" TFT	$250
9.4" DSTN	$150
10.4" TFT	$350
10.4" DSTN	$240

NoteBook Screens
340 Models in Stock
Obsolete Screens Stocked
Hard To Find LCD? Call!



CONTROLLERS

ISA
PCI
PC/104
NTSC
Analog VGA
Complete LCD Kits with LCD, Controller & Cable Starting under $200

EARTH
Computer Technologies
"The World Leader In LCD Recycling"

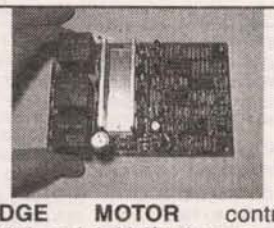
Ph: (949) 361-2333 Fax: (949) 361-2121
http://www.flat-panel.com

Write in 45 on Reader Service Card.

ROBOTICS

ROBOT BOOKS.COM visit our web site for reviews of robotics books, plus robot kits, toys, movies, and magazines! www.robotbooks.com

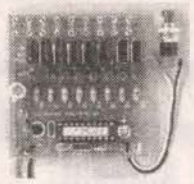
ARobot KIT from Arrick Robotics uses the BASIC Stamp II. Quality metal construction. Easy to assemble and very expandable. $235. http://www.robotics.com/arobot



H-BRIDGE MOTOR controllers. 12V ($25) and 24V ($35) versions. 35A average, 50A peak PWM out. Many features. Compact. Approximately 3.75" by 5.5". 570-735-5053. http://members.tripod.com/~divelec

BIPOLAR STEPPER driver (chopping type): 3 amp, current reduction when idle, 12-40V, $75, $65 (3 or more) www.brewingtons.com

PLANS – KITS – SCHEMATICS



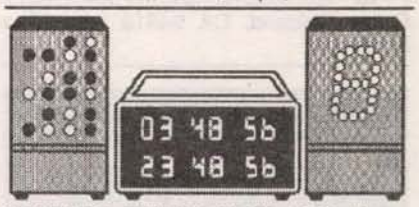
RUNNING LIGHTS KIT. Ideal for Christmas decorations etc. 8 LEDs switch on in 10 push button selectable patterns. 8 speed levels for a total of 80 combinations. Includes PCB, parts and instructions. $15.95 + $4.95 shipping. Can operate light bulbs with 8x TRIACs ($6 extra). Amazon Electronics, tel 1-888-549-3749. Lots of other products. www.electronics123.com

CONSUMERTRONICS 120+ exciting manuals: Electronics, computers, Internet, phones, energy, radionics, financial (including stocks), crime-fighting, security, survival, phenomena, **SPECIAL PROJECTS**. Catalog $3. PO Box 23097, Albuquerque, NM 87192. **www.tsc-global.com**

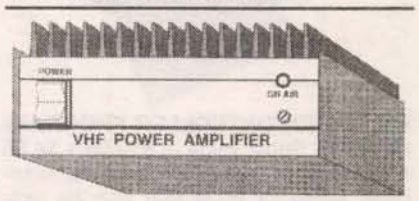
PCB Milling

CIRCUIT BOARDS. Low-cost, precision-made PC boards from your CAD program files (no photoplots required). Single and double-sided with contour routing. Ideal for RF/analog/digital prototypes. Full details at http://www.pcbmilling.com E-Mail: feedback@pcbmilling.com FAX: 703-818-0071.

ENCYCLOPEDIA OF electronic surveillance schematics: Schematics with parts identification, $20; **Amateur's guide to wiretapping,** $10. VHS, 1370 Trancas Street, #201, Napa, CA 94558.



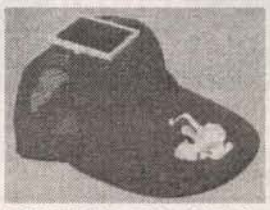
TERRIFIC TIMEPIECES! LED binary clock. LED digital clocks, other kits! Free catalog! WPC, 805-339-0702. **www.ElectronicsUSA.com**



BROADCAST FARTHER! 75-110MHz amplifier connects to stereo transmitters. Produces 2-15 watts. Requires 50-150mW drive. Complete plans with part source and antenna information only $14 + $2 S&H. **Progressive Concepts,** PO Box 586, Streamwood, IL 60107. 630-736-9822.

MANUALS – SCHEMATICS WANTED

MISCELLANEOUS ELECTRONICS FOR SALE



SOLAR-POWERED FAN HAT. Baseball type hat with solar powered fan. Great for sports fans, golfers, etc. Available in red or blue. $19 plus $2.00 shipping. CA residents add 7.75% sales tax. Visa/MC/Disc/Amex OK. H.T. Orr Computer Supplies, 249 Juanita Way, Placentia, CA 92670. 714-528-9822, 1-800-377-2023, FAX 714-993-6216.

NUCLEAR ELECTRONICS (NIM, CAMAC), PMTs, optics, high vacuum, and high voltage components and equipment. Guaranteed quality at reasonable cost. OE Technologies, Box 703, La Madera, NM 87539. Ph: 505-583-2482, Fax: 505-583-9190, E-Mail: oetech@newmexico.com http://www.oetech.com

TIMELESS PRODUCTS

The Best Prices and Service • In Business over 15 years!

Phone 218-346-6660 Fax 218-346-6664

CABLE TV CONVERTERS

WILL NOT DECODE

New! "TP 125 V"
128 Channel Converter with Volume

Special Prices for TP1550PC Call for Details

Panasonic still available!

• REFURBISHED CONVERTERS ALSO AVAILABLE •
• QUALITY REPAIR DEPARTMENT FOR ALL YOUR TUNER REPAIRS •
• REMOTES AVAILABLE FOR MOST CABLE BOXES •

DEALERS ONLY • GREAT QUANTITY PRICES • NO DECODER SALES

Write in 46 on Reader Service Card.

REFILL INKS FOR INKJET PRINTERS

Refill your old cartridge and save. All refill kits come with instructions and needed materials for refilling inkjet cartridges. Success guaranteed. Available for the following:

CANON BC-01, BC-02 CANON BJ10e, APPLE STYLEWRITER, BJ-200 Single, Black, $8.00. **CANON BJC-600** (BC-201) Single Black or Single Colors (3 refills) $8.00. **CANON BJ-130/300/330 & IBM Exec Jet** (Cart #BJI-481 & BJI-642) Black - 3-bottle kit $22.00. **CANON BJC-210/240** (BC-05 Cart) 3-color kit (3 refills each color for BC-05) $24.00. **CANON BJC-4000** and Apple Stylewriter 2400 Black 3-bottle kit (3 refills BC-20, 9 refills BCI-21 black, 30 refills BCI-11 black, 10 refills BCI-10) $19.00. **CANON BJC-4000/BJC70** and **Apple Stylewriter 2400** Tri-color kit - 6 refills each color for BCI-21 or 15 refills each color for BCI-11 $24.00. **CANON BJC-800/820/880** 3-bottle kit (for BJI-643B) $19.00. **CANON BJC-800/820/880** 3-bottle tri-color kit (Cart #BJI-643CMY) $24.00. **EPSON STYLUS COLOR PRINTER** - (Cart S020034) Single Triple black $19.00; Tri-color kit (Cart S020036) 2 refills each color $24.00. **EPSON STYLUS COLOR II** - (S020047) Triple Black $19.00 (S020049). Tri-color (2 refills each color) $24.00. **EPSON STYLUS COLOR 400, 500, & 600** (S020093) Triple black (7 refills total) $19.00. **EPSON STYLUS COLOR 200, 500** (S020097) Tri-color 3 refills each color $24.00. **EPSON STYLUS COLOR 400, 600, 800, 1520** Tri-color (S020089) 3 refills each color $24.00. **EPSON STYLUS 800/1000** (S020025) 3-refill kit, black, $19.00. **EPSON STYLUS COLOR 440 AND 640** Black refill kit. (S020187) 4 refills plus free vacuum bottle $19.00. **EPSON STYLUS COLOR 440, 640, AND 740** (S020191) Color refill kit. 4 refills of each color $24.00. **HP DESKJET 500/550/560** (51608A, 51633A, 51626A) Black single refills $8.00. **HP DESKJET 500/550/560.** Black 3-bottle kit $19.00. **HP DESKJET 500C/550C/560C .** Tri-color kit (5 refills each color) $24.00. **HP DESKJET 1200C, DESIGNJET 650** (Cart #HP 51640B) Black Three pack (3 refills) $19.00. **HP DESKJET 1200C/1600C, DESIGNJET 650** (Cart #HP 51640 C,M,Y). Tri-color kit (one refill each color) $24.00. **HP DESKJET 600/660** (HP 51629A) Black three pack $19.00. **HP DESKJET 600C/660C.** (HP 51649A) Tri-color (5 refills each color) $24.00. **HP DESKJET 855C/1600C** (HP 51645A) Black three pack $19.00. **HP DESKJET 855C** (HP 51641A) Tri-color kit (2 refills each color) $24.00. **HP PAINTJET** and **PAINTJET XL** (51606A) Black 3-bottle kit $19.00. **HP PAINTJET** and **PAINTJET XL** (51606C) Tri-color kit $24.00. **HP PAINTJET XL300** (C1645A & C1656A) Black 3-refill kit $19.00. **HP PAINTJET XL300** Tri-color kit (1 refill each color) HP 51639C,M,Y $24.00. **HP THINKJET, QUIETJET, KODAK DICONIX 150** (51604A or 92261A) black 5 refills $9.00. **IBM/Lexmark/Execjet/4076** (1380620) black 3-refill kit $19.00. **IBM/Lexmark ExecJet IIC, WinWriter 150 C** (Cart #1380619) 4 refills each color $24.00. **Lexmark 3200, 5000, 5700, 7000, 7200, Optra 45 and Z51** (12A1970) 3 refills Black $19.00. **Lexmark 3200, 6000, 5700, 7000, Optra 45 and Z51** (12A1980) 4 refills each color $24.00. **SNAP AND FILL SYSTEM** - Permits refilling HP 51626A (black for HP 500-series) and HP 51629A (black for HP 600-series) cartridges without making a hole in the cartridge. Consists of special cartridge holder, syringe, plastic tubing, and directions. **STARTER KIT** - with ink for 3 refills $28.00. **EXTRA INK FOR SNAP & FILL SYSTEM** (black only) 4-oz. bottle $18.00; 8-oz. bottle $34.00. Specify whether for HP 51626A or HP 51629A.

HARD-TO-GET PRINTER RIBBONS

Gorilla Banana, Commodore 1525 **$8.00**; Adam Coleco **$12.00**; TI-850/855 **$6.00**; Centronics 700 Zip Pack **$5.00**; C. Itoh Prowriter Jr., Riteman C+/F+ **$6.00**; Riteman Inforunner **$8.00**; Commodore MPS-801 **$5.00**; MPS 803 **$5.00**; Decwriter LA30/36 **$4.00**; Apple Scribe **$4.00**; Mannisman Tally Spirit 80, Commodore 1526 **$5.00**; Epson JX-80 4-Color **$14.00**. Printronix P-1013 **$11.00**; Star SJ144 color 3-pack **$29.00**.
ALSO HEAT & TRANSFER RIBBONS AND PAPER FOR PRINTING T-SHIRTS.

Over 300 different ribbons in stock. All ribbons new, not re-inked. Fully guaranteed. Order directly or send SASE for complete list.

Add $4 per order shipping. CA residents add 7.75% sales tax. On ribbon orders over $50 deduct 10% dis-

H.T. ORR Computer Supplies
249 Juanita Way, Placentia, CA 92870-2216
714-528-9822 · 800-377-2023 · FAX 714-993-6216
http://www.extremeplay.com/occomp/orr.htm

Write in 47 on Reader Service Card.

Quality Used Test Equipment

90 DAY WARRANTY Parts & Labor - 10 DAY TRIAL PERIOD

HEWLETT PACKARD

11570A, Accessory Kit (use for 8405A calibration) $300
11720A, Pulse Modulator, 2-18 GHz, >80dB on/off ratio.... $400
11975A, 2-8GHz Amplifer (use w/ 11970 series mixers) .. $1750
214B, 10 MHz Pulse Generator, 200W Pulse/50 ohms $700
2225A, ThinkJet Printer, HPIB $125
239A, Audio Oscillator, .0025% (-93dB) THD $250
3314A, Arbitrary/Function Generator $1250
3325A-2, 21MHz Synth Func Gen, 40Vp-p, HPIB $850
33322H, Prog Attnenuator, DC-18GHz, 0-110dB $200
3403C, Digital RMS Voltmeter, 2 Hz-100 MHz $150
3421A-201/44462A, Data Aquisition Control Unit, HPIB .. $325
3455A, 6.5 digit Multimeter, HPIB $250
3456A, 6.5 digit Multimeter, HPIB $450
3468B, 5.5 digit Multimeter, HP-IL $300
3478A, 5.5 digit Multimeter $350
3488A, Switch/Control Unit $350
3497A, Data Acquisition/Control Unit $150
3498A, Data Acquisition Extender $300
3852A, Data Acq/Control Unit $800
435A, Power Meter w/sensor cable $200
436A-02-022, Power Meter w/ sensor cable, HPIB $550
44462A/63A, 8 Chan MUX/2 Chan Actuator (3421A) $135
491C, Amplifier, 2 GHz-4GHz, 1 Watt, 30dB Gain $250
5004A, Signature Analyzer $200
5180A, Waveform Recorder, 20MHz $500
5314A, 100 MHz Counter $150
5315B, 100 MHz Counter $200
5316B, 100 MHz Counter, HPIB $275
5328A-011-020-030, 512 MHz Counter w/DVM, HPIB $225
5334A-060, 100 MHz Counter, front & rear input, HPIB $300
5334B, 100 MHz Counter, HPIB $400
5335A, 200 MHz Counter, HPIB $575
5335A-10-40, 200 MHz Counter, Oven Oscillator, HPIB $725
5342A, Microwave Counter, 18GHz, Oven Osc, HPIB $900
6034A, Dig Autoranging Pwr Sup, 60V/10A/200W, HPIB $650
6034L, Dig Autoranging Pwr Sup, 60V/10A/200W, HPIB .. $575
6110A (Harrison), Pwr Sup, 3KV @ 6mA $150
6253A, Dual Pwr. Sup., 0-20V@3A $275
6255A, Dual Pwr Sup, 0-40V@1.5A $350
6267B, Pwr Sup, 0-40V @10A $450
6268B, Pwr Sup, 0-40V@30A $600
6271B, Pwr Sup, 0-60V@3A $225
6284A, Pwr Sup, 0-20V@3A $100
6289A, Pwr Sup, 0-40V@1.5A $100
6294A, Pwr Sup, 0-60V@1A $100
6515A, Pwr Sup, 0-1.6KV@5mA (cable kit incl) $200
7550A, Graphics Plotter, HPIB $200
7570A, Draft Pro Plotter, HPIB $250
8111A, 20 MHz Pulse/Function Generator, 16Vp-p $1250
8160A, 50MHz Programmable Pulse Generator, HPIB..... $1600
8447A, RF Amp, 0.1-400MHz, 20dB gain, +6dBm out $300
8472A, Crystal Detector, 0.01-18 GHz $100
8481A, Power Sensor, .01-18 GHz, -30 to +20dBm $475
8496H, Programmable Attenuator, DC-18 GHz, 0-110 dB .. $375
8501A, Storage Normalizer (use w/8505A) $750
85041A, Transistor Test Fixture Kit $500
85131D, 3.5MM Test Port Cable Set (new) use on 8515A .. $475
8566A, Spectrum Analyzer, 100Hz-22GHz, HPIB $12500
8568B, Spectrum Analyzer, 100Hz-1.5GHz, HPIB $7500
8569B, Spectrun Analyzer, 0.01-22GHz, HPIB $5000
8640B, Signal Generator, 0.5-512 MHz, AM/FM/Pulse $700
8660C/86633B/86603A, 2.6GHz Synth Sig Gen $1800
8662A, Synthesized Signal Generator, .01-1280 MHz $15500
8672A opt 4 & 8, Synth Signal Generator, 2-18GHz $4000
8903B-001, Audio Analyzer, 20 Hz-100 KHz, rear input .. $1500
9411B, Switch Controller, HPIB $450
9413A, VHF Switch $450
E1407A, VXI A/B-C-Size Active Adapter $200

TEKTRONIX

1240-05/(4)D1's, Logic Analyzer w/ (4) P6460 probes $650
2465B, 400 MHz O'Scope, 4-channel $3600
7854, Keyboard Only $125
7A24, 400MHz Dual Trace Amplifier $175
7B92A, 500MHz Dual Time Base $125
A6302, Current Probe $300
AM503, Current Probe Amplifier $250
P6136, 10X probe, 350 MHz, use w/2400 series o'scopes .. $100
P6452, Data Aquision Probe (use w/ DAS9100) $150
P6460, Data Aquisition Probe (for 1240/1241 Analyzer) $150
PG502, 250 MHz Pulse Generator, use w/TM500 series $300
PS503A, Triple Pwr Sup, 0 to +/-20V@1A, 5V@1A $150
TDS460-1M, 350 MHz Digital O'Scope, 4-Channel, extra memory, includes 2 new P6138A probes & manuals $4500
TDS540A-1F-1M, 500 MHz Digital O'Scope, 4-Channel, extra memory, 1.44 floppy, 4 new P6139A probes, manuals .. $8000

MISCELLANEOUS

AstroMed ASC902, Medium Gain Amplifier Plug-in $100
Boonton 92BD, RF Milivoltmeter, 10KHz-1.2GHz $250
Clarostat 240C, Power Decade Resistor, 0-1,111,110 ohm .. $150
Eaton DSRS-5DA, 7-Decade Synchro/Resolver Std $800
EIP 545A-05-08, Microwave Counter, 10 Hz-18 GHz $550
EMI TCR160T30, Pwr Sup, 0-160V@30A $700
Fluke 6010A, Synthesized Func Gen, 10Hz-11MHz, GPIB $225
Fluke 8922A, Digital RMS Voltmeter, 2 Hz-11 MHz $400
GenRad 1538A, Strobotac, 110-150,000 RPM strobe $350
Heise 711B, Digital Pressure Gauge, 0 to 30 PSI, .05% $350
Interface 553, Mil-Std-1553 Anaylzer $850
Kepco BHK1000-0.2M, Pwr Sup, 0-1000V @ 200mA $275
Microdyne 1400-MR Telemetry Receiver w/Plug-ins $800
PAR 128, Lock-in Amplifier, 0.5Hz-100KHz $500
RF Power Labs M102L, RF Amp, 30Hz-100MHz, 2W $450
Sorensen DCR20-115B, Pwr Sup, 0-20V@115A $475
Sorensen SRL40-25, Pwr Sup, 0-40V@25A $475
Wavetek 178, 50MHz Programmable Waveform Synth $900
Wavetek 271-02, 12MHz Pulse/Func Gen, GPIB $400
Wavetek 859, 50 MHz Prog Pulse Generator, GPIB $575

Come visit us at our new website: www.testequipmentplus.com

TEST EQUIPMENT PLUS
(520) 575-6967, FAX (520) 575-6936
3331 W. Bright Terrace, Tucson, AZ 85741

Write in 48 on Reader Service Card.

PC CABLES: http://www.pccables.com connectors, RS232, IDC, SVHS, ribbon cable, DB9, DB15, loopback, null modem, jumpers, SCSI, screws, rails. Secure online catalog, ordering, browsing. 954-418-0817.

HIGH QUALITY TOOLS AND STAINLESS STEEL HARDWARE. European and American screwdrivers, nutdrivers, pliers, hex-keys, balldrivers, and more! Wiha, Bondhus, and Knipex. Stainless cap screws, machine screws, nuts, washers, U-bolts, and eyes. Free catalog. Robert Mink Import-Export, Box 6437V, Fair Haven, NJ 07704. Telephone or fax 732-758-8388. E-Mail: w2tv@csi.com

ATTENTION TV-AUDIO SERVICERS! Jobe Electronics has 1,000,000+ OEM parts for sale. 1960s-1990s at below wholesale cost. Call 618-993-6340 for more information. Vintage parts specialists, most brands. TV main board assemblies $10 ea., over 100 in stock! Call 618-993-6340.

NEED PC boards No. 130180-002, No. on bottom 4141005204, or flybacks No. 044015-00 or Lifon No. 7050302030. These monitors made by Falco Data Products, Inc. I have an accumulation of old tubes, modules, test equipment, and other TV, radio repair parts for sale. Over 40 years in the same area, please help me. If I can help you, send a SASE with your needs to Eddie Moore TV Service, 2680 Lockhart Hwy, Union, SC 29379.

When Visiting Disney World And Sea World. . .
Come To The World Of Electronic Surplus!

SKYCRAFT
PARTS & SURPLUS, INC.
ORLANDO, FLORIDA

Located At The Intersection Of I-4 And Fairbanks Avenue.

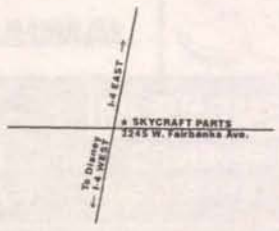
Self-Service Retail Outlet Featuring Commercial And Government Electronic Surplus Including:

- ★ WIRE
- ★ SWITCHES
- ★ RESISTORS
- ★ TRANSISTORS
- ★ TRANSFORMERS
- ★ TEST EQUIPMENT
- ★ NI-CAD BATTERIES
- ★ COAX
- ★ RELAYS
- ★ HARDWARE
- ★ CAPACITORS
- ★ PANEL METERS
- ★ CIRCUIT BOARDS
- ★ INTEGRATED CIRCUITS

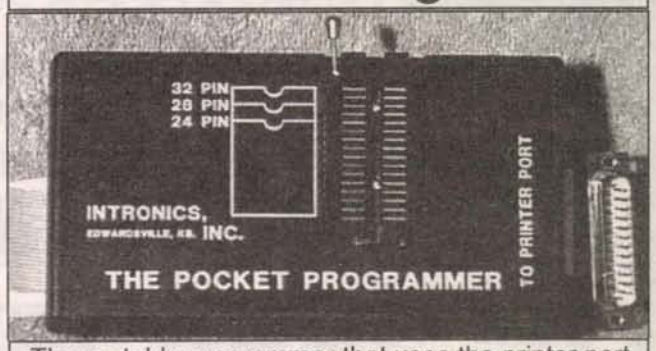
★ ★ ★ ★ ★ ★ ★ ★ ★

We Buy Surplus Electronic Parts —
FAX your list.
www.skycraftsurplus.com
FAX 407/647-4831
PH 407/628-5634
P.O. BOX 536186
ORLANDO, FLA. 32853-6186

HOURS:
Monday - Friday 8:30-6:00
Saturday 8:30-5:00



The Pocket Programmer



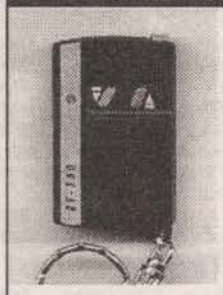
The portable programmer that uses the printer port of your PC instead of a internal card. Easy to use software that programs E(E)prom, Flash & Dallas Ram. 27(C)/28(C)/28F/ 29F/29CXXXX & 25XX series from 16K to 8 Megabit with a 32 pin socket. Adapters available for Pic, MCU's 874X, 875X, 40-Pin X 16 & Serial Eprom's, PLCC, 5-Gang, 82/74 Prom's and Eprom Emulator to 32K X 8.
Only $129.95

Same Name, Address & Phone Number for 16 Years.... Now isn't that Amazing ?

Intronics, Inc.
Box 13723 / 612 Newton St.
Edwardsville, KS 66113 **Add $5.00 COD**
Tel. (913) 422-2094 **Add $4.00 Shipping**
Fax (913) 441-1623 Visa / Master Charge / Amex

Miniature Transmitters and Receivers

2 Button / 3 Channel Transmitter



RF300T

1....$22.95
5.....$19.95 ea
10...$16.95 ea

RF300XT

1....$25.95
5.....$22.95 ea
10...$19.95 ea

- 300' (XT), 150' (T) Range
- Frequency: 318 MHz
- 59,049 Settable Security Codes
- 12 Volt Battery and Keychain Included
- Current Draw: 4.8 ma
- Fully Assembled in Case
- Dimensions: 1.25" x 2.0" x .5"
- Push both buttons for the 3rd Channel
- Slide Button Cover Included

4 Button / 15 Channel Transmitter

RF304XT

1....$27.95
5.....$24.95 ea
10...$21.95 ea

- 250' Range
- Frequency: 318 MHz
- 6,561 Settable Security Codes
- 12 Volt Battery and Keychain Included
- Current Draw: 4.6 ma
- Fully Assembled in Case
- Dimensions: 1.35" x 2.25" x .5"
- Push combination of buttons to achieve up to 15 channels

2-4 Data / 3-15 Channel Receivers

RF300RL
RF300RM

1....$27.95
5.....$24.95 ea
10...$22.95 ea

RF304RL
RF304RM

1....$29.95
5.....$26.95 ea
10...$23.95 ea

- Compatible with 300/4 Transmitters
- 11-24 volts DC Operating Voltage
- 13 ma. Current Draw
- Latching (L) or Momentary (M) Output
- Kits Available (subtract $5.00 ea.)
- Dimensions: 1.25" x 3.75" x .5"
- 2 (300) / 4 (304) Output Data Lines
- Binary to Dec / Hex Converter can achieve up to 15 channels

- Alarm Systems
- Garage / Gate Openers
- Lighting Control
- Magic Props
- Medical Alert
- Monitoring Systems
- Industrial Controls
- Surveillance Control
- Motor Control
- Schematics Available
- Receiver Board Layout Available
- Custom Design Consulting Available

Visitect Inc. (510) 651-1425 Fax: (510) 651-8454 Email: Support@Visitect.Com
P.O. Box 14156, Fremont, CA 94539 Visa / Mastercard, COD

Write in 49 on Reader Service Card.

ANAHEIM WIRE PRODUCTS. DISTRIBUTOR OF ELECTRICAL WIRE AND CABLE since 1973. Items available from our stock: Hook up wire, Automotive primary wire, GXL, SXL, Plenum cable, Teflon wire, Multi-conductor cable, Irradiated PVC, SO-CORD, Mil-Spec wire, Building wire, Welding cable, Battery cable, Telephone wire, Shrink tubing, Cable ties, Connectors. Wire cut & strip to specs. If interested, please call **1-800-626-7540**, FAX: 714-771-5043. Visa/MC/Amex. SEE US ON THE INTERNET: http://www.anaheimwire.com OR E-Mail: info@anaheimwire.com

HIGHEND EQUIPMENT 203-744-4111. OK INDUSTRIES DEMO BLOWOUT. If it is not listed just give us a call, chances are we have it! **SOLDER STATIONS**: total rework, forced convection, hot air. MTR5000 (retail $4,595) sell $1,700; MTR4000 (retail $3,995) sell $1,400; MTR3001 (retail $2,495) sell $900; BTR2001 (retail $1,595) sell $500; FCR2001 (retail $1,850) sell $700; BTR1000 (retail $825) sell $300; SMT1160 (retail $995) sell $400; SA2000 (retail $395) sell $140; SA1000 (retail $295) sell $100; SA500 (retail $145) sell $50. **PUR-AIR**: Fume exactors. EP101 (retail $1,695) sell $200; EP051 (retail $595) sell $100. **JEM**: Batch ovens JEM310 (retail $7,995) sell $2,500; JEM210 (retail $4,995) sell $1,000. **PICK & PLACE**: Chip placers, vacuum pencils, fluid dispensers. SMT8501 (retail $4,595) sell $1,500; SMT880 (retail $2,200) sell $500; FD1000 (retail $495) sell $150; VP100 (retail $395) sell $100. **BOARD ETCHER**: SSP-75A (retail $995) sell $300. **ALWAYS BUYING: VIDEO, RADIO, PHONE SYSTEMS, COMPUTERS, STEREO, AND BROADCAST EQUIPMENT.**

Gibraltar Trade Center
COMPUTER & TECHNOLOGY SHOWS

ATTENTION VENDORS

3 DAY SHOW FRIDAY OPTIONAL

$65.00 PER 8' TABLE

- TREMENDOUS ADVERTISING SUPPORT
- IMPRESSIVE CROWDS
- EASY SET UP & TEAR DOWN
- CONVENIENT NEARBY HOTELS

TAKE A LOOK www.gibraltartrade.com

TAYLOR, MI

NOVEMBER 26 - 28, 1999
DECEMBER 17 - 19, 1999
JANUARY 7 - 9, 2000

MT. CLEMENS, MI

DECEMBER 10 - 12, 1999
SUNDAY, DEC. 26TH 1999
(ONE DAY ONLY)
JANUARY 14 - 16, 2000

Gibraltar TRADE CENTER, INC.

MT. CLEMENS, MI
I-94 & N. RIVER RD.
(EXIT 237) • 810-465-6440

TAYLOR, MI
I-75 & EUREKA RD.
(EXIT 36) • 734-287-2000

Write in 50 on Reader Service Card.

HARD-TO-find parts; big screen tubes $135; 13", 19", 25" $25; electronic tuners $20; RF modulators $5; modules, knobs, flybacks. Call 912-272-6561. Scarborough TV, 1422 Old River Rd., East Dublin, GA 31027.

FREE FLYER on DBS, cable TV, phones, credit cards, schematics, health items. Bill 1-800-879-9657.

MISCELLANEOUS ELECTRONICS WANTED

HIGHEST PRICES PAID: I will pay the following prices for Western Electric tubes: 211A/D/E new $300, used $175; 212A/D/E new $750, used $275; 274A/B (engraved base) new $250, used $200; 300B (engraved base) used $550; 422A new $50, used $25; 437A new $50, used $25; and many more. Also buying Western Electric, and other audio tube and equipment literature. Call or send us your list. Toll free tel/fax: 1-888-715-8823. Don Singerhouse/Singerhouse Sound, LLC, PO Box 321, New Richmond, WI 54017. E-Mail: singtube@frontiernet.net

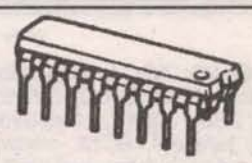
WANTED: TUBE HiFi/commercial amps, preamps, corner/horn speakers. Altec, Marantz, McIntosh, Western Electric, etc. 405-737-3312 fax 405-737-3355.

WANTED: X-BAND radar equipment. Military, civilian, working or not, parts, TMs, etc. Box 10215, Pittsburgh, PA 15232.

WESTERN ELECTRIC wanted: 1920s-1960s. Amplifiers, mixers, pre-amps, speakers, tubes, etc. FREE OFFER 1-800-251-5454.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dilog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.,** 937-847-2300 OR fax 937-847-2350.

WANTED: TUBES, radios, transmitters, receivers, gyros, bearings, connectors, relays, lamps, synchros. Hyness Company, 709B Delair Road, Cranbury, NJ 08512-4212. Phone: 609-395-1116, FAX 609-395-1117.



WANTED: EXCESS ELECTRONIC COMPONENTS, BOARD-LEVEL COMPONENTS; MILITARY COMPONENTS; ICs, MEMORY, TRANSISTORS, DIODES, CAPS, RELAYS, ETC. CALL LA PALMA SEMICONDUCTOR, 714-523-8892 FAX 714-523-8898.

NEEDED: WATER cooled induction heaters, hi-voltage supplies, variable 0-60KV, 0-10mA. Contact Ian, phone 864-882-6580.

WANTED: GENERAL radio type 1670-A magnetic test set. 847-759-0651. rewollrab@aol.com

WANTED: STANCOR/Chicago PCO/PSO-150, PCC-55, PCC-200. Also audio equipment by Langevin or Fairchild. R. Robinson, POB 1425, Wallingford, CT 06492. 203-949-0871. Richmix@eros.com

BBS & ONLINE SERVICES

INTERNET SECRETS revealed! Download up to $100,000 in Software for free, plus over 30 mind-boggling secrets. **Call 900-820-1221 ext. 4266. In Canada, call 900-830-4700 ext. 8830.** $2.99 per min. Must be 18 yrs. Serv-U 619-645-8434.

2539 W. 237th Street, Bldg. F, Torrance, CA 90505
Order desk only: USA: (800) 872-8878 CA: (800) 223-9977
LA. & Technical Info: (310) 784-5488 Fax: (310) 784-7590
http://www.digisys.net/timeline

TIMELINE INC.

Over 14 years and 32,000 customers and still growing

Minimum Order: $20.00. Minimum shipping and handling charge $5.00. We accept cashiers checks, MC or VISA. No personal checks or COD's. CA residents add 8.25% sales tax. We are not responsible for typographical errors. All merchandise subject to prior sale. Phone orders welcome. Foreign orders require special handling. Prices subject to change without notice. 20% restocking fee for returned orders.

Liquid Crystal Displays

240x64 dot LCD with built-in controller.
AND 4021ST-EO. *Unit is EL back-lit.* $59.00 or 2 for $109.00 *or*
OPTREX. DMF5005 *(non back-lit)* $49.00 or 2 for $89.00
20 character x 8 line
7¼L x 2⅜H
The built-in controller allows you to do text and graphics.

Alphanumeric—parallel interface

16x1	$6.00	20x2	$8.00	32x2	$8.00
16x1 (lg. char.)	$8.00	20x4	$8.00	40x1	$8.00
16x2	$6.00	20x4 (lg. char.)	$10.00	40x2	2 for $20.00
16x2 (lg. char.)	$10.00	24x2	$8.00	40x4	$20.00
16x4	$12.00	32x4	$10.00	4x2	$5.00

5V power required • Built-in C-MOS LCD driver & controller • Easy "microprocessor" interface • 98 ASCII character generator • *Certain models are backlit, call for more info.*

Graphics and alphanumeric—serial interface

size	Mfr.	price	size	Mfr.	price
640x480 (backlit)	Epson	$20.00	480x128	Hitachi	$10.00
640x400 (backlit)	Panasonic	$15.00	256x128	Epson	$20.00
640x200	Toshiba	$15.00	240x128 (backlit)	Optrex	$20.00
480x128 (backlit)	ALPS	$10.00	240x64	Epson	$15.00
			160x128	Optrex	$15.00

6" VGA LCD 640X480, Sanyo LMDK55-22 **$19.00**

Monitors

9" COLOR SVGA MONITOR $169.00
Fully Enclosed – Tilt and swivel type.

Monitors

Non-Enclosed TTL
Comes with pinout. 12V at 1.4 Amp input • Horizontal frequency 15Khz. • Ability to do 40 and 80 column.
5 inch Amber $19.00 • 7 inch Amber $19.00
9 inch Amber or Green $19.00

5" COLOR MONITOR $29.00
• Flat Faceplate • 320 x 200 Dot Resolution • CGA & Hercules Compatible
• 12 VDC Operation • 15.75 KHz Horiz. Freq. • 60 Hz Vert. Sync. Freq.
• Open Frame Construction • Standard Interface Connector • Degaussing Coil included • Mfr. Samtron
2 for $49.00

Hacker Corner

EMBEDDED 486 COMPUTER
$79.00 2 for $149.00
Complete enhanced Intel 486SX-33 based computer in ultra small (9-7/8L x 6-5/8W x 3-1/8H) case. Ideal for embedded operations or as a second computer. Features include: • One 16 bit ISA slot • 3 serial ports plus dedicated printer port • Parallel optical coupled adapter port • Built in IBM PC/AT keyboard port • On board VGA video and port • Uses standard SIMM up to 32 MB • BIOS is PC/AT compatible
Unit has a backup Ni-Cd battery system in case of power failure (5 min. backup time) and lockable front cover to prevent floppy drive access. Mounting / interface provisions for standard 3.5" laptop floppy and 2.5 inch hard drives. Comes with very comprehensive manual.

4 INCH LCD MONITOR $49.00
Compact (4.4" x 3.8" x 1.4") TFT active matrix LCD color monitor including fluorescent backlight. Analog RGB and composite sync input with switchable horizontal / vertical viewing. Low power consumption and long life backlight make it ideal for security and door phone use. Single 8 VDC supply and good resolution allow mobile operations or use with laptops. Standard ribbon cable - Molex connector interface. Complete specifications included.

SONY Miniature Color LCD Display (LCX005BKB) $29.00
• 1.4 CM (0.55 inch) Diagonal Full Color Display • Built In Horizontal and Vertical Drivers • Delta Dot Pattern for High Picture Quality - 537 dots (H) x 222 dots (V) • Compatible with NTSC & PAL Format and Sync Inputs • 12 VDC Operation with -1 to +17 V RGB Signal and Driver Input Voltage • Excellent Display for Virtual Reality Projects, Viewfinders, and Miniature Test Equipment Displays • Pin Outs and Specification Included • Unit Requires Clock, Synchronization and Video
1.8cm (0.7 inch) unit LCX009AKB 827H x 228V $29.00

CELL SITE TRANSCEIVER $29.00 2 for $49.00
These transceivers were designed for operation in an AMPS (Advanced Mobile Phone Service) cell site. The 20 MHz bandwidth of the transceiver allows it to operate on all 666 channels allocated. The transmit channels are 870.030-889.980 MHz with the receive channels 45 HMz below those frequencies. A digital synthesizer is utilized to generate the selected frequency. Each unit contains two independent receivers to demodulate voice and data with a Receive Signal Strength Indicator (RSSI) circuit to select the one with the best signal strength. The transmitter provides a 1.5 watt modulated signal to drive an external power amplifier. channel selection is accomplished with a 10 bit binary input via a connector on the back panel. Other interface requirements for operation are 26 VDC (unregulated) and an 18.990 MHz reference frequency for the digital synthesizer. The units contain independent boards for receivers, exciter, synthesizer, tunable front end, and interface assembly (which includes power supplies and voltage-controlled oscillator). Service manual, schematics and circuit descriptions included.

NTSC COMPOSITE 4" LCD MONITOR $69.00

Write in 51 on Reader Service Card.

EDUCATION

GET CERTIFIED NOW! MCSE $1,295, A+ $395. Approved courses. Limited time offer. 1-800-583-2140.

BUSINESS OPPORTUNITIES

COUNTER-SURVEILLANCE=$250 HR! Electronic eavesdropping is unbelievably widespread! Are you sure you're safe? Learn how others (without prior experience) earn **$250 HR** in the fascinating field of COUNTER-SURVEILLANCE! For FREE catalog call: **1-800-732-5000.**

REPAIRS – SERVICES

PICS, GALS READ if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

MONITOR REPAIR: Flat fee repair, sales, troubleshooting booklets. www.computervision.net

PC BOARDS REPAIRED. Prices start at $5. Minimum 5 of one type. Network Sales, 616-683-0500.

ENGINEERING CONSULTING. Product development from conceptual to manufacturing stages. Digital, analog, and RF expertise. Microcontroller designs for HC05xx, HC11xx, and PIC families. Software design for IBM PC. XILINX and Altera FPGA design. In-house schematic capture and PWB. Hicks Electronic Design, PO Box 7366, Loveland, CO 80537-0366. Toll Free 1-888-849-6792 E-Mail: steve@hickseng ineering.com website: www.hickseng ineering.com

RADIO REPAIR! Reasonable charges. Jim Rupe, 998 Whipple, Grayland, WA 98547-0697. 360-267-4011. E-Mail: w7ddf@yahoo.com

CABLE CONVERTER REPAIR: Quality repair service for all name brands. If you're tired of the runaround you're getting from the company you purchased it from, or they're out of business. Give us a call for fast and courteous service, Have model and problem ready. Sorry no box, chip, or IL repairs. **Highview Engineering 815-245-3735** or E-Mail: HIGHENG1@AOL.COM ask for George.

PRINTED CIRCUIT design by professional with 30+ years: conventional, multilayer, downhole, fine line. Prototype and production fabrication. Reverse engineer existing 2-layer board. Toll free 877-236-3223. www.circuit-applied-tech.com

PC BOARD ASSEMBLY. Thru hole only. Small or large quantities OK. Call Network Sales. 616-683-0500.

(E)EPROM PROGRAMMING done quickly and economically. One day turn around typical. Simple copy $3 per device. Also prototyping, design, and consulting services available. Call or send SASE to: **Luzer Electronics, 4023 North Bayberry, Wichita, KS 67226. 316-687-2127, FAX 316-687-3103.**

PLAYSTATION MOD chips. New Dino mode program. Works with all models up to 900x. Color instructions. Seven wire hook up, does not come with wires. $5 each, plus shipping charges. 10% discount for 10 or more. Call 703-764-5118 to place an order.

WELD ALUMINUM WITH PROPANE! EZ, INEXPENSIVE, STRONG. DETAILS: WEEKS, 36 CAROLINA ST., TAYLORS, SC 29687. 1-800-547-WELD(9353) FAX 864-244-6349. http://www.dura-fix.com

SECURITY BITS: Torx, Hex, Tri-Wing, Spanner, and more. Quality 33 piece set, $14.95 plus $4.75 shipping. Send check or money order to Chuck's Tools, 200 Donizetti Dr., Westminster, MD 21157 or to pay by credit card, visit our website at www.chuckstools.com

Sell Nuts & Volts in your store and earn $$$!
Contact us for details. 909-371-8497
E-Mail distributors@nutsvolts.com

The Nuts & Bolts of Robotics

From Nuts & Volts:

Build Your Own Robot!
by Karl Lunt
ISBN: 1-56881-102-0
Paperback; ca. 450 pages, $34.00

This compilation of articles from the author's long-running column for *Nuts & Volts* is a must-read for all robotics enthusiasts!

About Nuts & Bolts:

The Personal Robot Navigator
by Merl K. Miller, Nelson B. Wrinkless III, Joseph H. Bosworth, and Kent Phelps
ISBN: 1-888193-00-X
Paperback; 224 pp.; $44.95
includes 3.5" diskette
(IBM PC compatible)

Learn to navigate your robot around your home or office with this book and software combination!

To Find the Right Nuts & Bolts for You:

Personal Robotics: Real Robots to Construct, Program, and Explore the World
by Richard Raucci
ISBN: 1-56881-089-X
Paperback; 208 pp.; $25.00

This book, an overview of robotics kits currently available, will help you to find a robot that matches your skill level and pocketbook!

A K Peters, Ltd.
63 South Ave. Natick, MA 01760
508-655-9933, fax 508-655-5847
www.akpeters.com, service@akpeters.com

AMATEUR ROBOTICS NOTEBOOK

by Robert Nansel

Last month, I got my software-only I2C master and slave talking (sort of) by the simple expedient of the master sending all ones for the second byte of the datagram so the slave could echo the first byte. That was good enough to check out the low-level slave routines but, this month, I'll continue with the next iteration: making the master actually pay attention to what the slave is doing. I'll also give a book review to close out the year – some good winter reading for the amateur roboticist.

First up, though, is Pulse Width Modulation and a nifty new PWM part that will be of interest to robot builders.

PWM Motor Control

The Breadbot design, like most amateur robots its size, relies on hobby servos for its drive system. Hobby servos are easy to modify for continuous rotation, and they are simple to control. You merely provide them with a 1.0 to 2.0 millisecond pulse repeating at, say, 50 Hz, and you are in business.

It's the ease of generating these control pulses in software that is the reason why hobby servos have been so popular. After all, they are not all that precise, and the analog circuitry contained in the servos drifts with time, temperature, humidity, and phase of the moon, so even a carefully calibrated servo will not stay calibrated. And they are only really good for small robots weighing under a pound.

When you start building larger robots (as I intend to in the coming year), or when you need more precise control than hobby servos can provide, you have to start looking at how to control more powerful DC motors, and the most common way to do this is with Pulse Width Modulation (PWM). PWM varies the duty cycle of a fixed-frequency digital pulse stream. The most common form of PWM control is so-called "Sign/Magnitude" control where the direction ("Sign") is relatively fixed and the speed ("Magnitude") is determined by a PWM waveform.

In principle, the duty cycle can vary over the whole range from 0% (full OFF) to 100% (full ON), but most cheap permanent magnet gearhead motors only run with decent torque above 30% to 50% duty cycle; below a certain critical duty cycle (which varies with motor design and construction), the torque drops drastically, going completely nonlinear.

There is another form of PWM called Locked Anti-phase control. For Locked Anti-phase, the motor direction is controlled by PWM and the Magnitude is fixed. In other words, the direction is switched back and forth at the PWM rate so that the motor is motionless when the duty cycle is 50%, and rotates one way or the other as the duty cycle rises above or falls below 50%. It's useful for situations where you need to smoothly control a motor down through zero velocity without encountering the nonlinearities of Sign/Magnitude control.

PWM Whiners

I'll talk more about the subtleties of these Sign/Magnitude vs. Locked Anti-phase PWM control schemes in future columns. For this column, I'm more interested in how to generate the PWM. And how to avoid whining.

The problem with doing PWM control in software with either Sign/Magnitude or Locked Anti-phase is that the output frequencies achievable are low using software-only approaches – in the audio range. This means these systems whine, which can be annoying.

The only way to silence a whining motor is to increase the underlying PWM frequency above the audio range – to about 20 KHz, say – by using hardware to generate the PWM signal. Many microcontrollers provide some or all of the hardware you need to do PWM with minimal software overhead, but what if your processor doesn't? You'll have to add the extra hardware yourself.

Traditionally, this involves a high-frequency oscillator (in the MHz range) driving a collection of TTL or CMOS counters and binary magnitude comparators. The counters are typically a few four-bit 74HC160 or 74HC193 chips cascaded to form a synchronous counter of the number of bits you want. The outputs of the counters connect to the "A" inputs of the binary comparators – typically a few four-bit 74HC85 magnitude comparators – again cascaded to the desired word length.

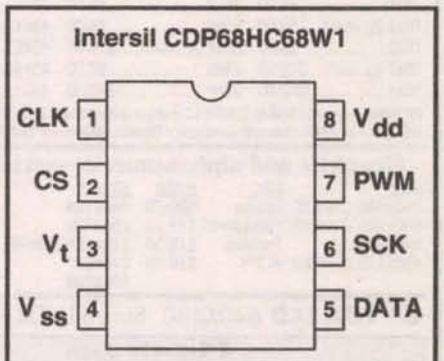


Figure 1: CMOS Serial Digital Pulse Width Modulator

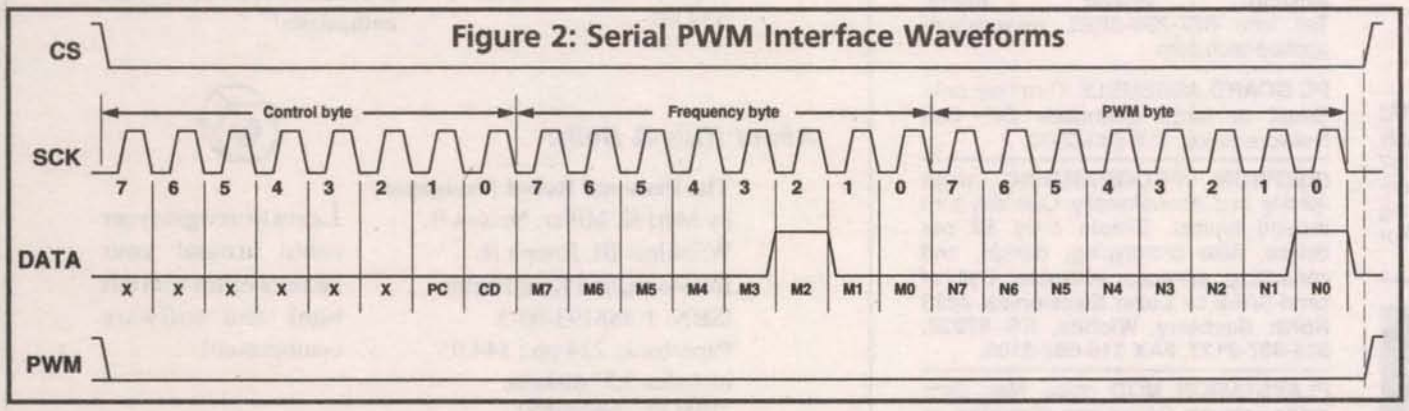
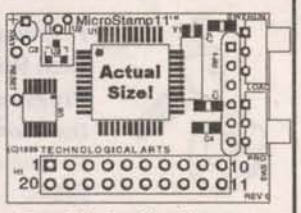


Figure 2: Serial PWM Interface Waveforms

World's Smallest 68HC11 Microcontroller Module!

MicroStamp11™

NEW!



- tiny 1-inch x 1.4-inch module
- 5V regulator, 8MHz crystal
- choice of 8K or 32K EEPROM
- plugs into your breadboard like a DIP
- SCI, SPI, OC, IC, timer, interrupts, and more
- all I/O lines brought out to versatile 20-pin connector
- easy programming/code-loading with Docking Module
- 8K Starter Package #MS11SP8K.....$49*
- 32K Starter Package #MS11SP32K.....$60*
- additional modules from $34 each

* Includes MicroStamp11, documentation, PC software, serial cable & Docking Module. Add $5 for shipping & handling

Possible Applications:
- *remote telemetry*
- *micro robotics*
- *smart sensors*
- *many more!*

Technological Arts

Visa•MasterCard Discover•Amex

Phone: (416) 963-8996 Fax: (416) 963-9179

www.technologicalarts.com

EZ-EP DEVICE PROGRAMMER - $169.95

Check Web!! -- *www.m2l.com*

Fast - Programs 27C010 in 23 seconds

Portable - Connects to PC Parallel Port

Versatile - Programs 2716-080 plus EE and flash (28, 29) to 32 pins

Inexpensive - Best for less than $200

- Correct implementation of manufacturer specified algorithms for fast, reliable programming.
- Easy to use menu based software has binary editor, read, verify, copy, etc. Free updates via bbs or web.
- Full over current detection on all device power supplies protects against bad chips and reverse insertion.
- Broad support for additional devices using adapters listed below.

Available Adapters

EP-PIC	(16C5x,61,62x,71,84)	$49.95
EP-PIC64	(16C62-5,72-4)	$39.95
EP-PIC12	(12C50x)	$39.95
EP-PIC17	(17C4x)	$49.95
EP-51	(8751,C51)	$39.95
EP-11E	(68HC11 E/A)	$59.95
EP-11D	(68HC711D3)	$39.95
EP-16	(16bit EPROMS)	$49.95
EP-Z8	(Z86E02,3,4,6,7,8)	$39.95
EP-SEE2	(93x,24x,25x,85x)	$39.95
EP-750	(87C750,1,2)	$59.95
EP-PEEL	(ICT22v10,18v8)	$59.95
EP-1051	(89C1051,2051)	$39.95
EP-PLCC	(PLCC EPROMs)	$49.95
EP-SOIC	(SOIC EPROMs)	$49.95
EP-TSOP	(TSOP EPROMs)	$59.95

Many Other Adapters Available

M²L Electronics

970/259-0555

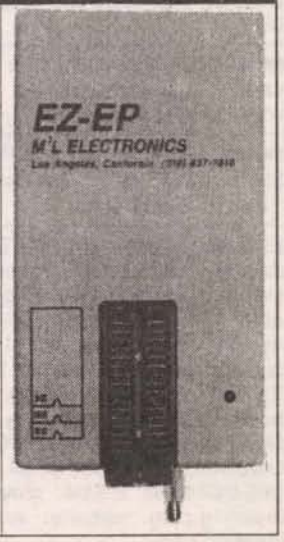
Fax:970/259-0777

250 CR 218

Durango, CO 81301

CO orders please add 7% sales tax

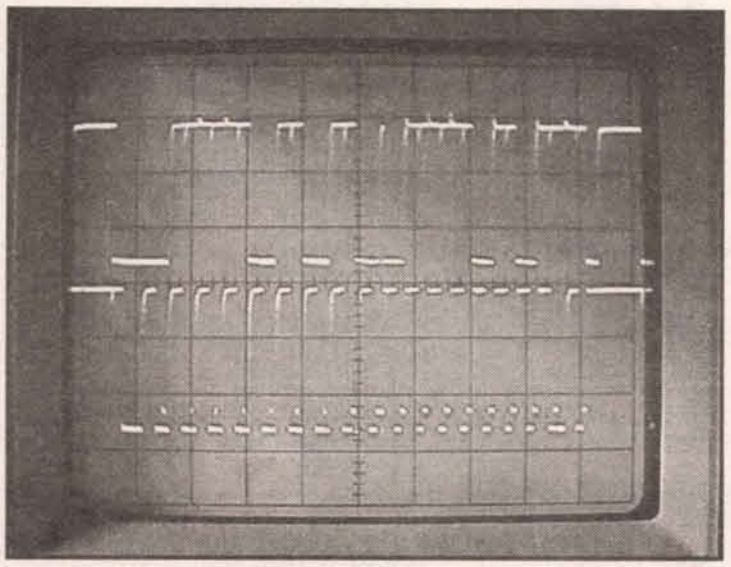
http:/www.m2l.com



Write in 111 on Reader Service Card.

NOTEBOOK

Shot of Oscilloscope I2C Waveforms



A register containing the binary word representing the PWM pulse width is tied to the corresponding "B" inputs of the comparators. The PWM output itself derives from the "A < B" output of the comparators so that the output is high as long as the binary count is less than the desired pulse-width count, and low thereafter. The high-frequency oscillator determines the maximum PWM frequency achievable, and the width of the counter and PWM words determine the resolution.

A four-bit PWM generator requires at a minimum three discrete logic chips – a counter, a comparator, and a register – using the above approach. This isn't counting the high-frequency oscillator, but that can often be shared with other PWM generators in your design. Likewise, an eight-bit PWM requires six chips. If you use an eight-bit counter and an eight-bit register, this drops the chip count down to four.

Unfortunately, eight-bit comparators are hard to come by, and using a simple eight-bit equality comparator – such as the 74HC688 – still requires the use of an additional flip-flop, so the chip count would still be four.

A 12-bit generator – not out of line for a precision servo-positioning system – would require as many as 12 logic chips. A 12-bit generator is about as far as you can go using readily-available logic because the required high-frequency oscillator for a 20-KHz PWM is over 80 MHz. To do it, you'd need to use ACT-family components, at least for the first four bits of the divider and comparator, since they must deal with the full clock rate of the oscillator.

Going to more than 12 bits isn't practical unless you resort to brute force approaches involving ECL chips. In high resolution PWM systems, it actually turns out that it's easier – and cleaner, from a digital noise perspective – to use a precision DAC to drive the input of an analog PWM generator.

Drowning in Chips

The thought of adding a dozen chips to a system as small as Breadbot is ludicrous and, even with larger robots, it would be nice to have a lower chip-count solution. It's not just the chips required, but also the number of I/O lines you need to drive the generators. An eight-bit system might need as many as 10 control lines just for the PWM generator: one to reset the counters and inhibit counting on startup, one to latch the control byte, and eight for the control byte itself. You can multiplex some of these lines, of course, but that makes your overall system more complicated.

There are some ways to reduce chip count when you are talking about more than one PWM channel. For instance, as with the high-frequency oscillator, the counter section can also be shared among more than one PWM generator. As long as you are within the fanout capacity of the counters, you can add as many comparators on the counter outputs as you like. Using this method, plus using an eight-bit counter, comparator, and eight-bit registers, a four-channel eight-bit PWM could be constructed from one counter, four registers, and four comparators, for nine chips total. If you have to use four-bit comparators, the chip-count would be 13.

This does nothing to alleviate the number of I/O lines required, though. The above nine-chip, four-channel circuit would use up as many as 34 output lines. If you have I/O lines in surplus, or if you are hanging the circuit directly off a 32-bit system bus, then you won't have a problem. But if lines

As always, if you have suggestions for improving Breadbot, if you've built a Breadbot, or if you have questions or comments about amateur robotics topics, you can reach me at:

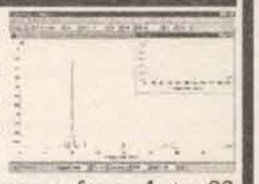
Robert Nansel
69 S. Fremont Ave. #2
Pittsburgh, PA 15202
E-Mail:
bnansel@nauticom.net

Digital Storage Oscilloscopes
From $99.00

ATC modules turn your PC into a full-function DSC, spectrum analyzer, logger, & DVM. Units DC to 50MHz. O-Scope II now in Windows 3.1, 95/98, NT and DOS.

O-Scope Ip	**$189.**
O-Scope II	**$349.**
Specialty probes	**call.**

ATC is a stocking distributor for Pico Technology LTD which offers scope modules to 100MSPS, resolutions from 8 to 16 bit.



Pico offers PC based data loggers from 1 to 22 channels, 8 to 16 bit and the Enviromon environmental monitoring system.

Pico products - call

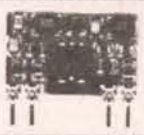
The DFA-5, **low cost differential amplifier,** cuts through common mode noise problems to reveal low voltage signals. With gains from 1X to 1000X and band widths from 20KHz to 1.2MHz, DFA-5 is the test accessory to help you work with signals from 5 Volts to 5 microVoltes. Only $129.00.

NEW DFA5

Serial Port Problems ? ? ?
Check out **Serial ! !** Our lowcost serial channel analyzer only $99.00.

Allison Technology Corporation
2006 Finney Vallet Rd., TX. 77471 U.S.A.
800-980-9806 or 281-239-8500
http://www.atcweb.com atc@accesscomm.net

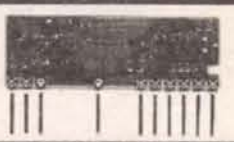
RF Data Modules



AM TRANSMITTER

- Small size: 17.78 x 11.43mm
- CMOS/TTL input
- No adjustable components
- Low Current. 4mA typical.
- 418MHz or 433.92MHz OOK
- Simple to integrate -simply add antenna, data and power
- Range up to 250ft.
- Wide supply range, 2-14Vdc
- SAW controlled - stability
- Also available in DIL package

AM-RT5 ..... $12.10



AM RECEIVER

- Compact size: 38.1 x 13.7mm
- On-board data recovery. CMOS
- Low current. 2.4mA typical
- 2kHz data rate. CMOS/TTL output
- 5Vdc operation
- On 418MHz or 433.92MHz (4xx)
- No adjustable components
- Patented Laser Trimmed component
- High stability
- Sensitivity: -105dBm
- Available also in 0.8mA version

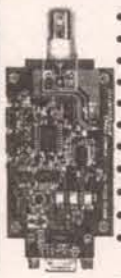
AM-HRR3-4xx $10.95

FM TRANSCEIVER

- Only 23 x 33 x 11mm
- Up to 40k bps data rate
- 19200 baud with ASCII
- Up to 500ft. range
- 5v operation
- 0.25mW into 50
- 418 or 433MHz FM
- Fast 1ms enable
- Direct interface to 5V CMOS
- Auto TX/RX changeover

BIM-4xx-F $87.36

RS232 TRANSCEIVER MODULES



- 4,800 to 38,400 bps half duplex
- 3-wire RS232 interface
- µController with user EEPROM
- RS232 interface protected to ±15kV
- Data packetizing performed by user
- Auto TX/RX changeover
- 418 MHz and 433MHz versions
- Range up to 500ft. (0.25mW ver.)
- 0.25mW & 10mW versions
- Reset switch and status LED's
- 7.5-15V dc via DB9 connector, 20mA

BIM-4xx-RS232 .... $139.30

70 x 65 x 15mm

- Up to 19,200 bps half duplex
- 3 wire RS232 interface
- Range up to 500ft
- Transparent data packetizing
- Supports 8 or 9 bit protocols
- Self test function
- Reset Switch & Staus LED's
- 1/4 wave wire antenna on board
- Available in a Simplex Tx/Rx pair.(RTcomTX & RTcomRx)
- 7.5V-15Vdc operation

Transceiver..... **RTcom-4xx..... $247.90**
Transmitter..... **RTcomTx-4xx..... $ 87.15**
Receiver..... **RTcomRx-4xx..... $105.52**

ABACOM TECHNOLOGIES

Free Catalog

Tel: (416)236-3858
Fax: (416)236-8866
www.abacom-tech.com
abacomtech@compuserve.com

```
title  "tstmast3.asm"

;  tstmast3.asm    -  Generate I2C Master test data pattern
;                             & read echoed data from I2C Slave
;
;          (c) 1999 by Robert Nansel <bnansel@nauticom.net>
;
; This program is free software; you can redistribute it and/or
; modify it under the terms of the GNU General Public License as
; published by the Free Software Foundation. Details of the GNU
; GPL can be found at www.fsf.org or by writing to the Free
; Software Foundation, Inc., 59 Temple Place, Suite 330, Boston,
; MA  02111-1307, USA.
; It comes with ABSOLUTELY NO WARRANTY, implied or otherwise.
;
; Revision history:  v0.01.0 - 9/8/99
;                             - basic low-level I2C master code
;
;                    v0.01.1 - 11/4/99
;                             - added clock stretch & bit arbitration
;                             - cleaned up constants & added #defines
;                             - cleaned up comments
;                             - corrected bugs in put_byte

      LIST P=16F84, F=INHX8M, R=DEC          ;  16F84 Runs at 10 MHz
         errorlevel 0,-305
      INCLUDE "\progra~1\mplab\p16F84.inc"

; ** Registers

 __CONFIG _CP_OFF & _WDT_OFF & _HS_OSC & _PWRTE_ON


; ** Constants

i2c_clr          equ     0xFC
i2c_set          equ     0x03
idle_out  equ    0x03
start_out equ    0x01

ack              equ     0x00
no_ack           equ     0xFF

arb_OK           equ     0x00
arb_jam          equ     0xFF

SCL              equ     0       ; Ser. Clock, bit 0 PortA
SDA              equ     1       ; Ser. Data, bit 1 PortA
SDA_mask         equ     0x02

#define R_SCL    PORTA, SCL      ; Read SCL, bit 0 PortA
#define R_SDA    PORTA, SDA      ; Read SDA, bit 1 PortA
#define W_SCL    TRISA, SCL      ; Write SCL, bit 0 TrisA
#define W_SDA    TRISA, SDA      ; Write SDA, bit 1 TrisA


; ** Delay values
;
; (these will eventually be used when invoking the delay macro)
;
F_Osc            equ     10                      ; 10 MHz XTAL
T_cyc            equ     10000/((F_Osc*10)/4)    ; T_cyc ns/cycle
T_buf            equ     ((47000/T_cyc)+5)/10    ; 4700 ns
T_hdsta          equ     ((40000/T_cyc)+5)/10    ; 4000 ns
T_low            equ     ((47000/T_cyc)+5)/10    ; 4700 ns
T_high           equ     ((40000/T_cyc)+5)/10    ; 4000 ns
T_susto          equ     ((40000/T_cyc)+5)/10    ; 4000 ns


;  RAM Usage

        CBLOCK 0x00C
_w              ; ISR context storage
_status
bit_count       ; bit shift counter
i2c_out         ; output buffer
i2c_in          ; input buffer
error_count     ; i2c data error count
temp            ; temporary storage
        ENDC

        PAGE

        org 0

; ** Test datagram read
;       entry:
;       exit:

test
        call    i2c_init
        clrf    error_count

test2
        call    i2c_wait        ; Wait for bus free condition
        call    start           ; Create START condition
        movlw   0x75            ; Set to read from addr 0111010b
        movwf   i2c_out
        call    put_byte        ; Send the address + R/W flag
        call    get_ack
        call    get_byte        ; Read data back from slave
        call    get_ack
        call    stop            ; Create STOP condition

; Debug code:
;  >>* Output running count of received data errors
;          (assumes slave echoes addr. byte sent to it)
;
        movf    i2c_in, w       ; Check that data received is
        xorwf   i2c_out, w      ;  same as data sent
        btfss   STATUS, Z       ; i2c_in = i2c_out ?
        incf    error_count     ; No, that's an error
        movf    error_count, w  ; Get i2c data error count
        movwf   PORTB           ; Output error count

; Alternate debug code:
;  >>* Output data received from slave
;
;       movwf   PORTB           ; Output received data

        goto    test2           ; repeat forever


; ** Initialize I2C port
;
i2c_init
        movlw   i2c_clr         ; Set up active low zeros
        andwf   PORTA           ; in PortA
        clrf    PORTB           ; Clear PortB for debug
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        movlw   i2c_set         ; Set up PA0, PA1 as inputs
        andwf   TRISA           ;
        clrf    TRISB           ; PortB as outputs for debug
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        return


; ** Wait for I2C Bus Free condition
;   (paranoid version)

i2c_wait
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        movf    TRISA           ; Get I2C bits
        andlw   i2c_clr         ;
        iorlw   idle_out        ; SCL=1, SDA=1
        movwf   TRISA           ; Output bus pin values
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        nop                     ; Let bus settle 1.2 usec to
                                ;  meet I2C 1 usec max rise time
wait2   movlw   idle_out        ; SCL=1, SDA=1
        xorwf   PORTA, w        ; Check bus state
        andlw   i2c_set         ;
        btfss   STATUS, Z       ; I2C bus idle?
        goto    wait2           ; No, go wait for bus idle
        movlw   idle_out        ; Yes, continue
        xorwf   PORTA, w        ; Check I2C bus state 2nd time
        andlw   i2c_set         ;
        btfss   STATUS, Z       ; Bus still idle?
        goto    wait2           ; No, go wait for bus idle
        movlw   idle_out        ; Yes, continue
        xorwf   PORTA, w        ; Check I2C bus state 3rd time
        andlw   i2c_set         ;
        btfss   STATUS, Z       ; Bus still idle?
        goto    wait2           ; No, go wait for bus idle
        return                  ;


; ** Create I2C START condition
;       entry:  SDA = 1, SCL = 1  (I2C Bus idle)
;       exit:   SDA, SCL = 0

start
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        bcf     W_SDA           ; Signal START condition
;       delay   T_hdsta-1       ; Delay to meet T_hdsta spec
        nop                     ; NOPs pad out 4 usec delay
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        bcf     W_SCL           ; Start clock low period
```

Listing 1

are scarce (as they usually are), you'll need to multiplex. By multiplexing the PWM control words onto one eight-bit port, you might get the I/O lines down to 13: one reset/inhibit line, four register selects, and eight data lines.

To reduce the interface still further, you must multiplex more I/O lines. The logical limit to this is a completely serial interface. Since you won't be changing the PWM values very often – motors, being mechanical, can only respond so fast – a simple registered-output shift register (such as the 74HC595) would be fast enough to update a PWM compare byte.

You could select each shift register directly with dedicated select lines, in which case you'd need just seven I/O lines, the reset/inhibit, the four selects, the shift clock, and the serial data out. Or, you could go for the absolute minimum number of I/O lines by stringing the shift registers together into one long shift register. In that case, you'd need just four lines: reset/inhibit, select, shift clock, and serial data out. The price you pay is you must shift out 32 bits each time you want to change any of the individual registers.

Serial PWM Chip

But what if you want a smaller solution for each PWM channel along with minimum I/O lines? Until recently, you'd have had to design it yourself with a PLD or two. But now there is a single-chip PWM generator with a serial interface. The CDP68HC68W1 from Intersil (formerly Harris) is just what we want, a Pulse Width Modulator chip with an SPI-type serial interface. It comes in an eight-pin plastic DIP package and is available for under $3.00 in small quantities (Figure 1).

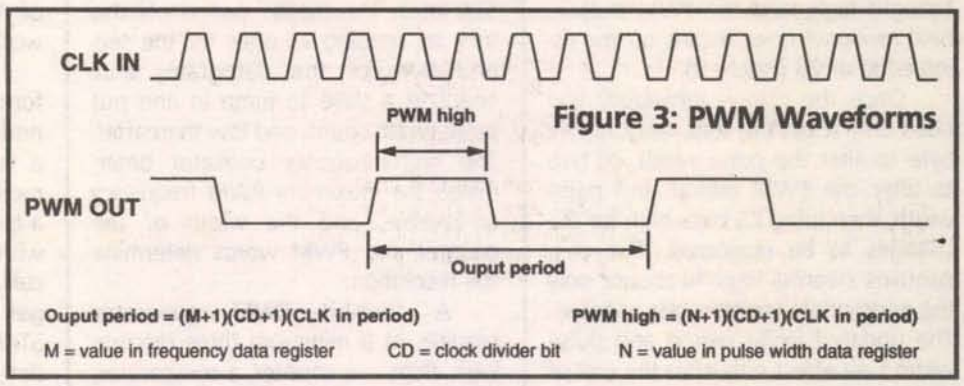


Figure 3: PWM Waveforms

This chip contains all the shift registers, comparators, counters, and assorted steering logic that make up a serial-interface PWM generator. What's more, the chip is programmable to any resolution up to eight-bit.

If four-bit resolution is all you need, you can configure the CDP68HC68W1 to do that. You can even produce resolutions that aren't powers of two. For example, you can program it to produce pulses from 1 to 100 counts of the input clock.

The chip runs from a Vdd of 4 to 6 volts at 1 mA. CLK is an input for the external high-frequency clock, CS is an active low chip select, and Vt – the Voltage threshold pin – is a sort of PWM inhibit that kicks in should the voltage on that pin rise more than 0.75 volt. This is useful for implementing thermal or over-current cutoff. Two pins – DATA and SCK – are SPI-compatible serial inputs with which you communicate to the device. PWM is the output.

You still need an external high-frequency oscillator to drive CLK, but many microcontrollers already output a suitable frequency for system clocking. Unfortunately, the spec sheets say the maximum input CLK frequency is 8 MHz, so you can't directly use the maximum 10-MHz system clock of a PIC16F84.

To use the CDP68HC68W1, you must first initialize it by bringing its CS line low, then clocking in three bytes containing 18 bits of information (Figure 2). The first byte goes to the Control Register. Only the two lower bits of this byte are used, PC and CD. PC is the power control bit used to place the chip in a low-power mode when its PWM output is not needed; Cd is the Clock Divider bit that provides an addition factor of two division of the CLK input when set.

The next byte is the Frequency Data Register, which is misnamed, in my view, because the number you put in this port determines the period of the resulting PWM output waveform. A larger number in this register makes for a longer period, an integral number of input CLK periods (or multiplied by two if CD is 1). The frequency is just the inverse of the period, though, so if you want frequency, it's simple to calculate.

The final initialization byte sent goes to the Pulse Width Register, which, as its name suggests, controls the pulse width of the high portion of the PWM waveform; it too is measured in units of input clock cycles. The CD bit affects the pulse width in the same way as the total PWM period as above. Initialization is done when CS is

Listing 1
continued

```
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        return

; ** Create I2C STOP Condition
;       entry:  SDA = X, SCL = 0
;       exit:   SDA = 1, SCL = 1  (I2C Bus idle)

stop
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        bcf     W_SDA           ; SDA=0
        bsf     W_SCL           ; SCL=1
;       delay   T_susto-1
        nop                     ; NOPs pad out 4 usec delay
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        bsf     W_SDA           ; SDA=1
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        return

; ** Put Byte
;
;       entry:  i2c_out = byte to send,
;               SDA = X, SCL = 0
;
;       exit:   temp = changed, i2c_out = unchanged
;
;           On byte successfully sent:
;               bit_count = 0, W = arb_OK
;               SDA = 1, SCL = 1;
;
;           On arbitration error:
;               bit_count = # bits not sent
;               W = arb_jam,
;               SDA = 1, SCL = 0

put_byte
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        movlw   8               ; # of bits to shift
        movwf   bit_count
        movf    i2c_out, w      ; Save output buffer
        movwf   temp            ;
shift_out
        rlf     temp            ; Shift msb into C
        btfsc   STATUS, C       ; If bit set
        goto    set_SDA         ; then set SDA bit

clr_SDA
        nop                     ;  (equalize loops)
        bcf     W_SDA           ; else clear SDA line
        bsf     W_SCL           ; Begin 4.0 us SCL high time
        nop                     ; Delay to let SCL settle
        nop

; ** check for SCL stretch
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        btfss   R_SCL           ; Did SCL go high?
        goto    $-1             ; No, SCL being stretched
        goto    clr_SCL         ; Cont. with SCL low cycle

set_SDA
        bsf     W_SDA           ; Set SDA line
        bsf     W_SCL           ; Begin 4.0 us SCL high time
        nop                     ; Delay to let SCL settle
        nop

; ** check for SCL stretch
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        btfss   R_SCL           ; Did SCL go high?
        goto    $-1             ; No, SCL being stretched

; ** Bit arbitration check
        btfss   R_SDA           ; Did SDA go high?
        retlw   arb_jam         ; No, return, arbitration lost

clr_SCL
        nop                     ; NOPs pad out 4.0 usec delay
        nop
        nop
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        bcf     W_SCL           ; begin 4.7 us SCL low time
        nop
        nop
        nop
        decfsz  bit_count; All bits shifted out?
        goto    shift_out ; no, go shift next bit
```

brought high, and the PWM output, held low until now, begins on the rising edge of CS (Figure 3).

Once the chip is initialized, you need only select the chip, clock in one byte to alter the pulse width, or two to alter the PWM period and pulse width, then bring CS back high for the changes to be registered. The chip contains steering logic to ensure only the appropriate registers get updated. The updated PWM period and pulse width take effect only after the end of the previous total output period. (Figure 4 shows the meanings of all the bits in the three registers.)

An Improved I2C Master

The last two columns, I've been using essentially the same version of code for the I2C master. That version was feeble, barely smart enough to generate I2C waveforms so I could bootstrap my I2C slave code. Except for checking for the Bus Free condition, it blissfully ignored the outside world as seen through the SDA and SCL lines. The master pulled off this trick by sending all ones for the second byte of the datagram, thus enabling a slave to jump in and put pulse-width count, and low thereafter. The high-frequency oscillator determines the maximum PWM frequency achievable, and the width of the counter and PWM words determine the resolution.

A four-bit PWM generator requires at a minimum three discrete logic chips — a counter, a comparator, and a register — using the above approach. This isn't counting the high-frequency oscillator, but that can often be shared with other PWM generators in your design. Likewise, an eight-bit PWM requires six chips. If you use an eight-bitter. This is not caused by the slave clock-stretching; last month's slave is fast enough that it releases SCL before the master is done with Tlow. Rather, it's caused by the slave's inability to synchronize any closer to the master's SCL transition than 0 to 4 instruction cycles. This is still well within the timing constraint of 12 cycles for Tlow, so everything works fine.

The jitter does make the waveform look messier, and datagrams are noticeably harder to trigger on to get a stable display on my 'scope. Last month, if I tweaked the trigger control a bit, I could get a reasonable display without using my external trigger circuit. This month, I found it difficult to get a stable display, even using the START output of my START/STOP detector circuit. (See Sept. '99 for details of this circuit.)

The display was so bad, in fact, I thought the revised master wasn't working. I could get a stable display if I pulled the slave out of the circuit, so I knew the master was transmitting something right but, when it interacted with the slave, it seemed like I was getting continuous START/STOP timing violations (i.e., that SDA was changing state while SCL was high other than during a START or STOP).

I got better results using the SYNCH output of the trigger circuit instead. The START output of the trigger circuit produces a variable-length, negative-going pulse. The exact length of the pulse is determined by the data the master sends. Apparently, the data I was using was giving START conniptions. When I changed over to SYNCH, things cleared up right away. SYNCH produces a pulse the same length as the datagram, independent of the data it carries.

Once I was able to see the datagram clearly on the 'scope, I had to verify that the master was actually receiving the data the slave was transmitting.

As it turned out, the routine get_byte had a couple major bugs in it. The first was a logical inversion of the incoming bit stream (the same kind of error I made in the slave last month ... sigh), and the second was shifting the i2c_in buffer one too many times. I cured the first by replacing "btfsc STATUS, Z" with "btfss STATUS, Z." I cured the second bug by moving "rlf i2c_in" above the clock-stretch check before the low bit of the

Listing 1 *continued*

```
        bsf     W_SDA           ; yes, clean up
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        retlw   arb_OK          ; Return, arbitration won

; ** Get Byte
;       entry:  SDA = X, SCL = 0
;       exit:   i2c_in = received byte, W = changed
;               bit_count = 0,
;               SDA = 1, SCL = 0
get_byte                ;
        movlw   8               ; # of bits to shift
        movwf   bit_count
        clrf    i2c_in          ;
        bcf     STATUS, C       ; Clear C to shift in zeros
        bsf     STATUS, RP0     ;  (Tris in Bank1)
shift_in                        ;
        bsf     W_SCL           ; begin 4.0 us SCL high time
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        nop                     ; Delay to let SCL settle

        rlf     i2c_in          ; shift bits left for next bit

; ** check for SCL stretch
        btfss   R_SCL           ; Did SCL go high?
        goto    $-1             ; No, SCL being stretched

        movlw   SDA_mask        ; Isolate SDA bit
        andwf   PORTA, w        ;
        btfss   STATUS, Z       ; SDA = 1 ?
        bsf     i2c_in, 0       ; yes, set LSB
                                ; else, LSB already clear
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        bcf     W_SCL           ; begin 4.7 us SCL low time
        nop                     ; NOPs pad out 4.7 usec
        nop                     ; T_low delay
        nop
        nop
        nop
        decfsz  bit_count       ; All bits shifted in?
        goto    shift_in        ; no, go shift next bit
        bsf     W_SDA           ; yes, clean up
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        return


; ** Give ACK
;
;       entry:  I2C Bus data read from Slave has just occurred,
;               SDA = 1, SCL = 0
;       exit:   ACK pulse generated, SDA = 1, SCL = 0

give_ack
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        bcf     W_SDA           ; Output ACK pulse
        bsf     W_SCL           ; begin 4.0 us SCL high time
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        nop
        nop

; ** check for SCL stretch
        btfss   R_SCL           ; Did SCL go high?
        goto    $-1             ; No, SCL being stretched

        bsf     STATUS, RP0     ;  (Tris in Bank1)
        nop                     ; Hard-coded to pad out 4.0 usec delay
        nop
        nop
        nop
        nop
        nop
        nop
        nop
        bcf     W_SCL           ; begin 4.7 us SCL low time
        bsf     W_SDA           ; clean up
        nop                     ; NOPs pad out 4.7 usec delay
        nop
        nop
        nop
        nop
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        return


;>>* Get ACK -> this versions ignores any returned ACK
;       entry:  I2C Bus address or data write has just occurred,
;               SDA = 1, SCL = 0
;       exit:   W = ACK status, SDA = 1, SCL = 0

get_ack
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        bsf     W_SCL           ; begin 4.0 us SCL high time
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        nop
        nop
; ** check for SCL stretch
        btfss   R_SCL           ; Did SCL go high?
        goto    $-1             ; No, SCL being stretched
        movlw   SDA_mask        ; Isolate SDA bit
        andwf   PORTA, w        ;

;>>* Commented out to ignore ACK for initial timing tests
;       btfsc   STATUS, Z       ; SDA = 0 ?
;       retlw   no_ack          ; no, signal No ACK
        nop                     ; NOPs to pad out 4.0 usec delay
        nop
        bsf     STATUS, RP0     ;  (Tris in Bank1)
        bcf     W_SCL           ; begin 4.7 us SCL low time
        bsf     W_SDA           ; clean up
        bcf     STATUS, RP0     ;  (Ports in Bank0)
        retlw   ack             ; Signal ACK

        end
```

Byte 1: Control Register

7	6	5	4	3	2	1	0
0	0	0	0	0	0	PC	CD

CR7–CR2 Unused; "don't care"

CR1 (PC) Power Control Bit. If bit is "0", chip remains in active state. If bit is "1", internal clocking, voltage camparator (VT) circuit, and voltage ref. are disabled, putting chip in low power mode. Active mode reentered by clearing PC and clocking in 24-bit initialization.

CR0 (CD) Clock Divider Bit. If bit is "0", chip will divide CLK input by one. If bit is "1" CLK input divided by two.

Byte 2: Frequency Data Register

7	6	5	4	3	2	1	0
PWM Frequency Register							

M7-M0 This register holds the byte that determines the total period of output PWM:

PWM Ouput Period = (M+1)(CD+1)(CLK in period)

M = value in frequency register
CD = value of Clock Dividerbit in control register

Example: for M = 5 and CD = 0, the PWM output period will be 6 input clock cycles long.

Byte 3: Pulse Width Data Register

7	6	5	4	3	2	1	0
Pulse Width Data Register							

N7-N0 This register holds the byte that determines the pulse width (high duration) of output PWM:

PW= (N+1)(CD+1)(CLK in period)

N = value in PW register
CD = value of Clock Dividerbit in control register

Example: for N = 3 and CD = 0, the PWM output will be high for 4 input clock cycles, then low for the remaining cycles. If the frequency register contains 5 as above, the PWM output will be high for 4 CLK cycles and low for 2.

Figure 4: Pulse Width Modulator Data Register

buffer is set or cleared. This ensures that i2c_in does not get shifted after the last bit is written to the buffer.

To discover these bugs, I used two different bits of debug code in test2 – the main loop. The first debug routine is a six-instruction code snippet that outputs to PortB a running count the times the byte sent doesn't equal the byte received. It assumes the slave always echoes the address byte sent to it (which is what last month's slave does). Putting a logic probe on PB0 will tell you right away if errors are piling up. If you set your logic probe to capture a pulse, you'll be sure of catching even one-time errors.

The second section of debug code, commented out in the listing, is just a simple write of the contents of i2c_in to PortB. To use it, uncomment the "movwf PORTB" instruction and comment out the above six instructions of debug code. Probing around the bits of PortB will quickly tell you if the master is receiving the correct data.

The next iteration, I'll work on improving both the master and the slave (though not simultaneously). In particular, I'm keen on writing high-level routines to build datagrams on the master side and to interpret them on the slave side. And, speaking of high-level, here's a book about a very high level of programming, indeed.

Spiritual Machines?

If you listen to some people, you'd think there is nothing truly new under the sun, that humanity will never rise above its mean genetic heritage, and that light beer will always taste bad. Ray Kurzweil doesn't listen to those people, and a good thing, too, or we perhaps wouldn't have had OCR, music synthesizers, and voice recognition systems as early

Go Wireless With Our Modules

SILRX/TXM
SILRX – $26.00 ea.
TXM – $15.50 ea.

The TXM and SILRX modules are a transmitter and receiver pair which can achieve a one-way radio data link-up to a distance of 200m over open ground.
Both units are supplied in space-saving single-in-line packages and offer SAW controlled, wide band FM transmission/reception.
The modules are particularly suited to battery-powered, portable applications where low power and small size are critical design criteria.

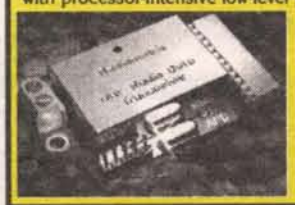
TX2/RX2
TX2 – $19.50 ea.
RX2 – $38.50 ea.

The TX2 and RX2 radio transmitter and receiver pair enable the simple implementation of a data link at up to 40kbit/s at distances up to 75m in-building and 300m open ground. Both modules combine full screening with extensive internal filtering to ensure EMC compliance by minimizing spurious radiations and susceptibilities. The TX2 and RX2 modules will suit one-to-one and multinode wireless links in applications including car and building security, EPOS and inventory tracking, remote industrial process monitoring, and computer networking.
Because of their small size and low power requirements, both modules are ideal for use in portable, battery-powered applications such as hand-held terminals.

900 MHz AVAILABLE NOW

RPC
RPC – $99.00 ea.

The RPC module is an intelligent transceiver which enables a radio network link to be simply implemented between a number of digital devices. The module combines an RF circuit with processor-intensive low-level packet formatting and recovery functionality, requiring only a simple antenna and 5V supply to operate with a microcontroller or a PC.



BiM
BiM – $69.00 ea.

The BiM module integrates a low-power UHF FM transmitter and matching superhet receiver together with data recovery and TX/RX change over circuits to provide a low-cost solution to implementing a bi-directional short-range radio data link.

Lemos International Co., Inc.
65 Southbridge Street, Auburn, MA 01501
Phone (508) 798-5004 ♦ Fax (508) 798-4782
www.lemosint.com ♦ sales@lemosint.com
All products available in either 418 or 433 MHz

Write in 112 on Reader Service Card.

Metric
Equipment Sales, Inc.
800-432-3424
Fax: 510-264-0886
www.metricsales.com

RENT • BUY • SELL
Yes, we will buy your surplus equipment!

Scopes, Meters, Analyzers, Power Supplies, Signal Generators, Counters, Recorders and more

Hewlett-Packard, Tektronix, Fluke, Dranetz, TTC, Anritsu, Wavetek, Keithley, and more

Test & Measurement Instruments
Over 7000 Models • 6-Month Warranty
Save 30-90% • 5-Day Free Trial

Write in 113 on Reader Service Card.

Power Quality Inc. 800-255-5545 Fax: 520-344-8847

Heavy Duty Surge Suppressor Plug Strips, 6 outlet, circuit breaker, Case of 25 in individual boxes..$50/case

HP Power Supplies, HP6260B current is 0-50A, ...$100

UPS, 250va to 3 kva, functional and nonfunctional .....Please call

Power Conditioners, Oneac, TLC, Teal, Sola, various sizes.....Please call

BMI, Dranetz, and RPM Power Quality Monitors.....Please call

www.powerqualityinc.com

SURPLUS SALE

1,000,000 WALL TRANSFORMERS

3VDC/100MA .... CX099 .... $0.75
6VDC/100MA .... CS039 .... $1.45
9VDC/100MA .... CR314 .... $1.45
12VDC/200MA .... CS033 .... $0.99
13.5VAC/400MA.. CR574 .... $1.29
24VDC/500MA .... CR174 .... $3.40

Min 1000/type -- Call for other types

SURPLUS TRADERS
PO Box 276,
Alburg, VT 05440
Tel: (01) 514-739-9328
Fax: (01) 514-345-8303
http://www.73.com/w

FREE CATALOG!

IC PROGRAMMERS

ADVANTECH BETOOLS NEEDHAMS DATA IO BP MICRO XELTEK SYSTEM GENERAL ICE TECHNOLOGY CHROMA

1295 Advantech Labtool-48
895 Needham EMP-30
869 EETool Topmax
650 Xeltek SuperPro III
629 ICE Tech Micromaster LV
469 Xeltek SuperPro F
419 Needham EMP-20
419 EETool Megamax
379 Xeltek SuperPro LX
299 EETool ChipMax
279 Xeltek Rommaster II
209 Needham EMP-10

Gang Programmers 4 TO 8 Sockets
CALL Advantech Labtool-848 8XGang
1085 EETool TopMax W/8XGang
689 Needham SA-20 8X Gang
529 EETool MegaMax4G 4XGang

WE CARRY THE BEST SELECTION IN THE WORLD!

General Device Instruments
Sales 916-393-1655 Fax 916-392-4949
Order Only Toll Free 800-760-3820

WWW.GENERALDEVICE.COM
WWW.LABTOOL.COM
LABTOOL-48
LABTOOL-848

BATTERY — YUASA

Sealed Lead-Acid/Gel-Cell
12V: 7AH $19, 2.3/4AH $16
18AH $39, 1.2AH $13
6V: 4AH $9, 10AH $13

Quantity Discounts Available
Call for other models

Aventrade
4518 Temple City Blvd., Temple City, CA 91780
Tel. 626-286-0118 Fax 626-287-9618
E-Mail: sales@aventrade.com
www.aventrade.com

CUSTOM PLASTIC PARTS

- MODELS (WOOD AND RESIN). TO EVALUATE YOUR PARTS BEFORE COMMITING TO MANUFACTURE A MOLD.
- MOLD DESIGN AND BUILDING.

- PRODUCTION OF INJECTION MOLDED PARTS. NO ORDER TO SMALL OR TO BIG.
- VERY COMPETITIVE ON HIGH LABOR PARTS.

We also have manual low pressure machines for injection molding of very small runs or prototypes of parts up to 2 oz. At a surprisingly low price.
USA. Office: V&V Mach.&Equip Inc.
Tel (281) 397-8101, Fax (281) 397-6220.
Please send blue prints or samples to:
Marketing Tech. S.A. •Alamo 93, 4.Piso • Sta. Monica, Tlal. • Edo. de Mexico 54040 • Tel. 011 (525) 361-3351. Fax 011(525) 361-5996. ATTN: VICTOR M.MENDOZA
e-mail. marktech@infosel.net.mx

PLEASE VISIT OUR SITE
WWW.VANDVMANCHY.COM

ITS 160 M SEASON!

MARCONI ANTENNA 700W 50 Ω
THE BEST "LITTLE" LOW BAND ANTENNA

EASY TO INSTALL.

– 160M –
130' OVERALL
$54.45 PP

– 80M –
67' OVERALL
$47.45 PP

SMART BATTERY CONTROLLERS KITS
AC OR SOLAR 110/220
1/2, 1, 3, 5 OR 6 AMPS
BUY THE MODULE
OR ENCLOSED VERSION

CODE PRACTICE OSCILLATOR.....$23.45 PP
J-POLE ANTENNAS: 2 M/440, 220 MHZ, 6 M
KITS, PORTABLE, OR FIXED-STATION
SEND FOR FREE CATALOG:
1-800 JADE PRO (523-3776)
www.jadeprod.com/
email: jadepro@jadeprod.com
JADE PRODUCTS INC. E. HAMPSTEAD NH 03826-0368

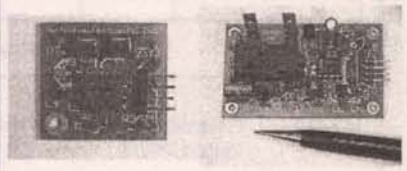
Price Reduction

- GPS Trimble SV6 w/ Mag Ant $49.95
- Rockwell MicroTracker I I $49.95

Just in - Siemens Gigaset 2420 2 unit Cordless System..... $199.00

Communications Surplus
713-526-8000 or
1-877-878-6GPS(477)
commsurplus@ev1.net
Fax to 713-522-6309

Sensors and Real Time Clocks



AT6 Digital Inclinometer kit
▲2-axis measure of variation from the level position
▲For robots, vehicles, more!
▲$59.95+ ship/handling

RHT7 kit
▲Relative Humidity & Temperature Sensor
▲Sends data over 100 feet
▲$64.95+ ship/handling

Visit our Webpage for more! See the MicroClock II kit!

Technology Electronics, Ltd.
Phone: 937-438-4683 Fax: 937-438-5934
www.technologykit.com kits@technologykit.com

HIDDEN SECURITY CAMERAS

Worlds Smallest Wireless Camera
434 MHz $249 900 MHz $249

Beeper Camera
PnP $225 434 MHz $379

Wireless Wall Clock Camera
PnP $195 434 MHz $349

Wireless Eyeglass Case Camera
PnP $195 434MHz $325

Wireless Clock Radio Camera
PnP $225 434 MHz $379

OTHER ITEMS AVAILABLE CALL FOR A FREE CATALOG

J. J. Hill, 188 Virginville Road, Hamburg Pa 19526
Phone: (610) 562-1532 **Fax:** (610-562-0658)

Data Acquisition and Control via RS232 or RS485 Ports

The ADR interfaces connect to any serial port and allow data acquisition and control using simple ASCII strings. Easy to use with BASIC, Visual Basic, C, TestPoint or LabVIEW.

Many versions available with A/D, D/A, DIO and relay I/O. Visit our web site for details.

ADR2100.....$199 ; 32 digital I/O (20mA) ; 4,10-bit analog inputs ; 2, PWM ports, 2 event counters ; 4 interrupts, 1 auxiliary output ; Dual stepper motor indexer ; RS232 to RS485 converter ;Daisy-chain up to 10 units ; Regulated 5VDC out@100mA

ONTRAK CONTROL SYSTEMS
Ontrak Control Systems Inc.
(705) 671-2652
(705) 671-6127 FAX

More products and applications at:
www.ontrak.net

TV 85 PJ & TV 86 CABLE CONVERTERS VOLUME & NON-VOLUME CONTROL

SALES/SERVICE
VOICE 1-800-473-0506
FAX 1-800-488-0525

FOSS WAREHOUSE DISTRIBUTORS
285 Schenck St.
N. Tonawanda, NY 14120
www.fossw.com

UHF Wireless Telephone Recorder
Easy to install Superb sound quality

ONLY $299.00

The UX-200 is a UHF telephone transmitter with combined Receiver & Recorder, which works with battery or mains. It will record up to 7 Hours and has a range of more than 100 meters.

Bitz Technology
E-mail:
Bitztechnology@compuserve.com

as we did.

Ray Kurzweil is well known as a technologist whose technology works, so when he talks about the future of computing, it pays to listen. And he has a lot to say in my pick for the book of the month, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (Viking Penguin, New York, 1999, ISBN 0-670-88217-8).

Spiritual Machines is in the same vein as Hans Morovec's recent book, Robot: *Mere Machine to Transcendent Mind*, (reviewed in these pages in the May '99 issue). Like Morovec, Kurzweil is attempting to predict the future evolution of robotics and artificial intelligence. Kurzweil puts rather more emphasis on AI than on robotics in his book, as you might expect given his background. He also comes to pretty much the same conclusions as Morovec: 30 years from now, human-level intelligence will be available in the equivalent of desktop personal computers.

I was fascinated by this book. In some ways Kurzweil, is bolder than Morovec. He places much more faith in traditional AI approaches, for instance, and he makes his case with all the fervor of Manifest Destiny.

I liked this book, though some of Kurzweil's notions are suspect. In particular, I don't believe his claim that there is an inherent force in the universe that must — of course — lead first to biological intelligence and inexorably on to machine intelligence. He talks glibly about evolution "speeding up" through what he calls the "law of accelerating returns."

I don't know, but I just get a rash when anyone starts talking about anything in an evolutionary system as being inevitable. I've read too much evolutionary biology (especially the writings of paleontologist Stephen Jay Gould) to see the outcomes of evolutionary processes as anything but contingent on accidents of history. Things didn't have to turn out the way they did, and we are not the pinnacle of the evolutionary ladder. Evolution doesn't work in such a linear fashion.

Still, even with the above caveats, I recommend this book. I happen to believe that Kurzweil is right about his technological assessments of what's in store the next century, even if I don't agree with his descriptions of how evolution works. It is possible to be right for the wrong reasons (something readers of my code listings will no doubt have already noticed).

Spirit vs. Brawn

Next time, I'll get to those higher-level routines for I2C and talk more about PWM motor control. I'm contemplating building some big robots this year, and that calls for big motors. Ah, I can almost smell the ozone and solder smoke already ... **NV**

PCB EXPRESS, INC.

PROTOTYPE TO PRODUCTION

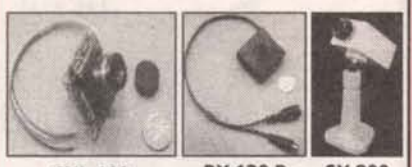
S/SIDED: 5-days, 10 Pcs.	$275.00
D/SIDED: 5-days, 5 Pcs.	$300.00
D/SIDED: 5-days, 10 Pcs.	$350.00
4-LAYERS: 5-days, 5 Pcs.	$750.00
4-LAYERS: 7-days, 10 Pcs.	$850.00
6-LAYERS: 5-days, 5 Pcs.	$950.00
6-LAYERS: 7-days, 10 Pcs.	$1,175.00

(Up to 30 sq. inch each, includes Tooling)

SERVICES – *UL Approved*
SMOBC, LP1 mask & Legend
Photoplotting, Electrical Testing
Thru hole/SMT, Gold/Nickel Plating
Routing and Scored Panel, Instant Quotes

PH: **(888) 427-2920**, Fax **(847) 427-1949**
E-Mail: cir1920@aol.com
LOWEST COST & FAST DELIVERY

VIDEO PRODUCTS



CNL-100	BX-120-P	SX-800
$49	$59	$79

- 430 TV Lines Resolution
- 9-14 VDC Operation
- Infrared Sensitive
- SX-800 has Audio Output
- A-300 Camera Enclosure also available

MATCO, INC.
Schaumburg, IL
1-800-719-9605 • 1-847-619-0852 FAX
E-Mail – info@mat-co.com
Website – www.mat-co.com

10&14 Hour Telephone Recorders

Starting at **$69** +$6.95 S/H
Times based on a 180 tape
14 Hour $89+S/H

120 Tape included!

Automatically starts recording when the phone is picked up and stops when you hang up. Records both sides of the conversation!
Printed catalog $3 (free with order)

Visit our Online Catalog
www.mscelectronics.com

MSC Electronics
PO BOX 461 Jessup, MD 20794
(301) 497-1600
FAX (301) 497-1925
No Checks • US & Canada Only

EPS

EPROMS AS LOW AS **25¢**

27C256	27C040	27C1024	87C51
27C512	27C400	28F010	8751
2732A	27C4096	28F020	8755
27C32	574000	28F040	MC68HC70
27C128	574200	8749H	5C8A
27C64	27C402	8748H	PIC16C56
2716	27C020	8741	PIC16C54
2708	27C210	8742	PIC16C622
27C512-90	27C010	8744	GAL16V8
			GAL22V10

STATIC RAM	PROCESSOR	MEMORY
HM628128	8255	D-RAMS
62256	8254	SIMM
6264	80C31	
6116		

- Many more parts in stock
- All major brands
- All guaranteed

E-Mail: eproms@aol.com
TEL: (818) 774-9444 · FAX: (818) 774-0822
WE BUY EXCESS INVENTORY

FREE SAMPLE COPY!

ANTIQUE RADIO CLASSIFIED

Antique Radio's Leading Monthly Magazine

Articles – Classifieds – Ads for Parts & Services. Also: Ham Equip. – Books – Telegraph – 40's, 50's & 60's Radios – Early TV – Auction Reports & more...

1-Year: $39.49 ($57.95 by 1st Class)
6-Month Trial - $19.95. Foreign - Write.

A.R.C., P.O. Box 802-G23
Carlisle, MA 01741
Call: 978-371-0512 — Fax: 978-371-7129
Web: www.antiqueradio.com

TOGGLE SWITCHES – All sizes and types
Commercial Quality

FULL SIZE TOGGLE SW. 1/2" DIA.				PRICE	
TYPE	MODEL	RATING	LEAD	100-1000	
SPST	D125	6A/125V	6" wire	.77	.67
SPST	D128	4A/125V	Solder	.57	.47
DPDT	D126	5A/125V	Solder	.77	.67
DPDT	D127	10A/125V	Solder	1.17	1.06
on-off-on		5A/250V	Screw		
MINIATURE TOGGLE SWITCHES 1/4" DIA.					
SPST	D131	6A/125V	Solder	.57	.47
SPDT	D132	6A/125V	Solder	.61	.51
SPDT	D129	6A/125V	Solder	.77	.67
mom-off-mom		3A/250V	Solder		
SPDT	D134	6A/125V	Solder	.77	.67
on-off-on		3A/250V	Solder		
DPDT	D133	6A/125V	Solder	.77	.67
DPDT	D135	6A/125V	Solder	.92	.82
on-off-on		3A/250V	Solder		
DPDT	D130	6A/125V	Solder	.92	.82
mom-off-mom		3A/250V	Solder		
MOMENTARY PUSHBUTTON SWITCHES 1/4" DIA.					
SPST Nor Open DM1		3A/125V	Solder	.32	.27
SPST Nor Close DM2		3A/125V	Solder	.32	.27

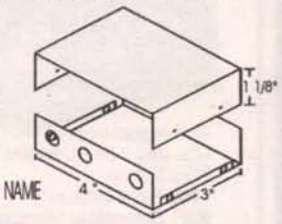
ANY ORDERS LESS THAN 100, ADD 20¢ EACH
LEDs Red, Yellow, Green — $12.00/100 $10.00/1,000

DEMAR ELECTRONICS
P.O. Box 7215, Algonquin, IL 60102
Toll Free 877-655-6433
Fax 847-854-4434

CABLE BOXES

CUT MANUFACTURING COST!
WE ACCEPT SMALL ORDERS TOO.

SHEET METAL
20 GAUGE
SILK SCREEN
PRINTED
WITH YOUR CO. NAME



ALSO PCB, SMT, PROTOTYPES, ASSEMBLY. PLASTIC MOLDS, INJECTION MOLDING

USA Office: **V&V Mach. & Equipment, Inc.**
Ph: (281) 397-8101, Fax: (281) 397-6220.
Mexico Plant: **Marketing Tech.**
Ph: 011 (525) 361-3351, Fax: 011 (525) 361-5996.
PLEASE VISIT OUR SITE
WWW.VANDVMACHY.COM

COVERT CATALOG2000

BRAND NEW!

The Latest, Up-to-date, Hands-on Supplier and Source Guide for:

- Electronic surveillance equipment
- Covert video cameras and transmitters
- Counter measures gear
- Entry supplies
- Electronic tracking systems
- Computer surveillance and remote viewing

Equipment, exact addresses and ordering info from 15 countries!! 220 pages — $39.95

II 3555 S El Camino Real, San Mateo, CA 94403
Phone 650-513-5549 ■ fax 650-728-0525 or www.intelligence.to (no "dot com")

ASSEMBLY & ENGINEERING

Producible designs since 1970

Contract Engineering
- Embedded Microprocessors
- PCB Layout and Packaging Design
- Analog Including RF to 1 GHz
- Instrumentation
- A/D and D/A

Contract Assembly
- High-Speed Fuji Surface Mount
- Through hole
- Turn-key or Kit
- Run sizes one through thousands
- Test and burn-in available

Bilocon Corp.
800-736-5927
425-353-2276
www.bilocon.com

Stereo Microscopes for Large PC boards

9 in. arm for Large boards
-10X & 30X
-Dust cover
-Eye guards
-5 year warranty
ST 231P – $395.00

jlittle@netwizards.
3580 Haven Ave. Redwood City. CA 94063
650/367-8320 Fax 365-5845

CONTROL • MEASURE • INPUT

MODEL 40–$109
- RS-232 Interface
- 28 lines digital I/O
- Eight analog inputs
- PWM output
- Three stepper ports

MODEL 100–$279
- 12-bit 100KHz A/D • Four analog outputs
- Three timer counters • 24 digital I/O

PRAIRIE DIGITAL, INC.
920 SEVENTEENTH ST., INDUSTRIAL PARK
PRAIRIE DU SAC, WI 53578
TEL: (608) 643-8599 · FAX: (608) 643-6754

dmdsystems.com

[electronic test & mfg]
[test]
[measurement]
[rf/microwave]
[specialized equipment]
[computers]

DMD SYSTEMS RECOVERY, INC.
602 305-8485
fax 602 305 8490 • email info@dmdsystems.com

ASTRO TOO

Surplus/Electronics Equipment

Web Site: AstroToo.Com
E-Mail: Astro@AstroToo.Com

2854 Sarno Road
Melbourne, FL 32935

(407) 253-3371
Fax: (407) 727-1546

When visiting Central Florida, come see us!
I-95, Exit 72

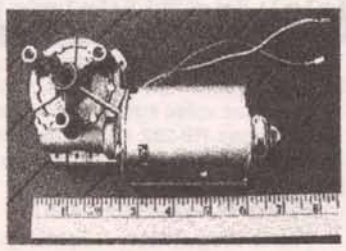
GRADE "A" CD RECORDABLE DISKS
DIAMONDBACK CD-R

DISK TYPE	QTY	EA	SPINDLE
74 Min. 650MB (on spindle)	100	.79	$79.00 Silver/Silver
80 Min. 700MB (on spindle)	100	$1.29	$129.00 Silver/Blue

- Excellent for Music and Data Integrity
- Reliable OEM Quality

Call Toll Free 1-(888) 967-8400

RISK FREE DISKS, INC.
— OUR 20TH YEAR —
www.riskfreedisks.com



GEARHEAD MOTORS, 24VDC, HIGH TORQUE
AVAILABLE IMMEDIATELY BRAND NEW OEM SURPLUS

UP TO 24V OPERATING VOLTAGE
.45A NO LOAD @ 24 VOLTS
35 REVOLUTIONS /MINUTE @ 24V
19 REVOLUTIONS /MINUTE @ 12V
3/8" DIA., 1" LONG SLOTTED SHAFT W/ 1/8" HOLE
WEIGHT: 2.5 LBS

PRICE: $10.00 EACH + SHIPPING
(CALL OR E-MAIL W/ YOUR ZIP FOR CHARGES)

DIVERSE ELECTRONIC SERVICES
1202 GEMINI ST
NANTICOKE, PA 18634-3305
570-735-5053 603-415-7649 [FAX]
carlk3nl@ccoms.com http://members.tripod.com/~diveloc

Doctor GB card / Xchanger
for Professional Game Developers

Doctor GB card is a Gameboy compatible ROM emulator FlashROM cartridge. It has built-in SRAM and supports MBC1, MBC2 and MBC5 standard.

GameBoy

The advanced design of the Doctor GB card and Doctor GB Xchanger makes it easy for programmers and coders to burn a ROM file to the Doctor GB card. To transfer data into the Doctor GB card, the only requirements are the Doctor GB Xchanger, PC and our customized software. No need for expensive and difficult to use EEPROM burner.

www.UpstateGames.com
E-mail : sales@upstategames.com Fax : (716) 442-7223
P.O. Box 40184 Rochester, NY 14604 U.S.A.

GPS Design Kit — $379

The design kit SGM5600KS is a complete and immediately usable means of evaluating the SiGEM GPS receiver module and high performance GPS antenna, which are included in the kit. Software running on the GPS receiver module communicates to a user supplied computer via NMEA 0183 formatted messages. Advanced PC software provides map integration and a demonstration of tracking. Provision has been made for DGPS inputs.

SiGEM Inc.
50 Hines Road
Kanata, Ontario
Canada K2K 2M5
Tel: (613) 271-1601 (Can)
(541) 923-3733 (USA)
Fax: (613) 271-1896
Web: www.sigem.ca
Email: info@sigem.ca

SiGEM

SINGLE SIDED PCBs — 9¢

9 ¢ PER SQIN, $100 SET UP,
SMOBC, ONE OUNCE COPPER,PC75, 1/16'',
ONE SOLDER MASK AND ONE SILK SCREEN.
NEGATIVES $ 50

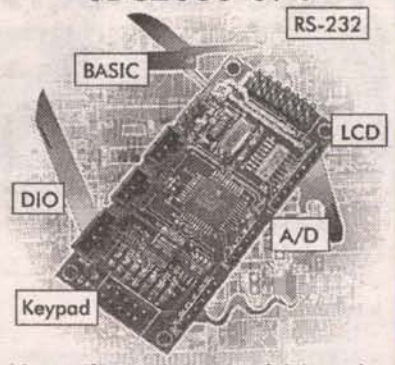
DOUBLE SIDED PCBs — 14¢

14 ¢ PER SQIN, $150 SET UP,
PTH, ONE OUNCE COPPER,
FR4, 1/16'', TWO SOLDER MASKS AND ONE
SILK SCREEN. NEGATIVES $ 75.

* THESE PRICES APPLY ONLY TO RECTANGULAR PCB'S

PLEASE VISIT OUR WEB SITE FOR MORE
INFORMATION AND OTHER PRICE EXCEPTIONS
WWW.VANDVMACHY.COM
V&V MACHY & EQUIP. INC (HOUSTON TX. OFFICE)
PH. (281) 397 6220
MARKETING TECH. S.A. (MEXICO PLANT)
PH. 011 525 361 3351, FAX. 011 525 361 5996

SBC2000-074

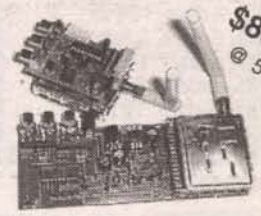


Versatility starting at $64 each.

Voice: 303.422.8088 Fax: 303.422.9800
www.sbc2000.com

Vesta Technology, Inc.

2.4 GHz Wireless Transmitter & Receiver



$89/pair @ 50 pcs

2.4 GHz – 2.48 GHz User Selectable
Over 700' Range and 4 Chl Auto-scan
NTSC, PAL, Composite video B/W or Color
2 Audio Inputs may be used for digital data
Customizations including battery packs
and Special Frequencies

Matco Inc.
(800)440-0299 or (800)719-9605
www.mat-co.com

Telecom Hardware/Software Developers

STOP using your phone lines to test and demonstrate your telecom devices. Our affordable telephone line simulators offer authentic USA dial tone, busy signals, ringing, and exceptional speech quality.

RING-IT! TELCO SIMULATOR
- Single Line (two RJ-11 Jacks)
- LED Display
- DTMF Operation
- Automatic Ring-up Mode
- **$325** ($149 kit available)

PARTY-LINE TELCO SIMULATOR
- Six Extensions
- Caller-ID (Name/Nbr)
- Distinctive Ringing
- **$425** ($199.95 kit avail)

Digital Products
COMPANY
134 Windstar Circle
Folsom, CA 95630 USA
Tel: 916-985-7219
Fax: 916-985-8460

http://www.digitalproductsco.com

LCD Terminal $99

Re-Programmable
LCD 240 x 64 EL Backlit
RS-232 Port
1200 Baud Modem
8051 Compatible Microcontroller
192k Low Power Static Memory
Infared Transmitter
Nicad Battery Pack
QWERTY Keyboard
FM SCA Data Receiver

Junkware.com
http://www.junkware.com

PC BOARD SERVICES

PCB Design Layout
- Thru Hole
- SMT
- Multilayer

PCB FABRICATION
- In-house Prototypes
- Single and Double Side
- Plate Thru Hole

ASSEMBLY
- Thru Hole
- Small Project Specialists

Serving Engineers and Hobbyists for 16 Years

MIDLAND TECHNOLOGIES
800-726-8871 Voice
406-586-0300 FAX

Press-n-Peel Transfer Film

PC Boards in Minutes

8.5" x 11" Shts.
* Or Photocopy
**Use standard household iron

1. LaserPrint*
2. Press On**
3. Peel Off
4. Etch

Use Standard Copper Clad Board
20 Shts $30/ 40 Shts $50/ 100 Shts $100
Visa/MC/PO/Ck/MO $4 S&H/Foreign Add $7

Techniks Inc.
P.O. Box 463, Ringoes NJ 08551
ph. 908.788.8249 fax 908.788.8837
www.techniks.com
Vist Our E-Store On-Line!

ATOMIC TIME

Automatic time synchronization for applications where accurate time is essential to data integrity

FEATURES
- WWVB based
- Serial and LCD outputs
- Y2K compatible
- 0.1 second accuracy

APPLICATIONS
- Network time servers
- Embedded systems
- Timers/sequencers

ULTRALINK
775 782 9758 www.ulio.com

New! ActiveWire™USB Simple USB Interface

- Internet Browser Script-able
- 24 MHz CPU core with USB
- Firmware downloadable via USB
- 16 bit parallel I/O
- Expandable add-on boards
- New firmware and scripts available from website

$59 plus shipping
ActiveWire, Inc.
www.activewireinc.com
ph(650) 493-8700 fx(650) 493-2200

QUALITY KITS

#1 Source for Electronic Kits

Great selection of Hi-Fi AUDIO Kits, PSUs, Transmitters, Oscilloscopes, PIC Programmers, and much more.

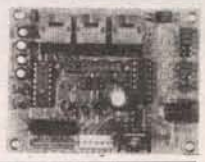
Toll Free Order Line:
1-888-464-5487

Secure On-Line Ordering
www.qkits.com

Call 613-544-6333 for free catalog
North American Kit Distributor
49 McMichael St., Kingston, ON
K7M 1M8, CANADA

Convert RS-232 to RS-485 or TTL/CMOS for Only $49.00

Communicate up to 4,000 feet, at up to 1 MEGA—BPS, full or half duplex, up to 32 units on one serial link, with 31 jumper options for flexible configuration, LED indicators.



COMMUNICATIONS CONVERTER
- FULL SCHEMATIC AND DOCUMENTATION
- FULL FAMILY OF MODULAR DESIGNS
- RS-485/RS-422 REMOTE I/O MODULE KITS
- NETWORK SOFTWARE AND SOURCE CODE
- AUTOMATIC OR RTS UNITS AVAILABLE
- RJ-11/12 CONNECTORS OR TERMINAL STRIP
- TURN YOUR PC INTO A DISTRIBUTED DATA ACQUISITION AND CONTROL SYSTEM

R.E. SMITH
(513) 874-4796
4311 TYLERSVILLE RD. ■ HAMILTON, OHIO 45011
www.rs485.com

Program PICs in Basic

Complete kits to get started!

Includes: PIC Basic Compiler, EPIC Programmer, 16F84 PIC, Cable & Batteries

ORDER

Electronic Products
www.elproducts.com

PRINT to VIDEO!

Tiny BOB-II module superimposes up to 308 characters on NTSC/PAL video or generates video automatically. Fast 2.4~19.2kbps RS-232 serial interface. Simple to control; like a printer. Many powerful applications:

Home Automation - MATV
Video Inspection & Testing
Surveillance - CCTV - ATV
Remotely Piloted Vehicles
Gaming - Racing - Sports
Process/Experiment Monitor
Robotics - Electronic Signs

BOB-II-NTSC only $79.95
Information & Ordering: www.decadenet.com
DECADE ENGINEERING
5504 ValView Dr. SE, Turner, OR 97392
Tel: 503.743.3194 – Fax: 503.743.2095

Globaltech Distributors

THE ULTIMATE ELECTRONIC SAVING STORE

Wholesale Prices Available---Don't Miss-Out
Call Today!---1-(800)582-5116

Computer Acc.	Recordable CD's
Remote Controls	Alkaline Batteries
Semiconductors	4 Wire Harness
IC's & Microprocessor	Anti-Virus Prog.
Radios & Amplifiers	Soldering Stations
Satellite Acc.	Cellular Chargers
Telephone Acc.	Hearing Aids
Anti-Tapping Devices	Laser Pointers
2-Way Radios	Power Supplies

**Free Internet Service - Free Color Catalog*

Buy Direct Buy Today & Save
Order@globaltechdistributors.com

Be a winner like

Rick Capps
of Fernley, NV
and
Marvin Laster
of Philadelphia, PA

Find out how on page 49!!

CALL TOLL FREE
(800) 292-7711
Orders Only
Se Habla Español

C&S SALES

Secure On-line Ordering @ cs-sales.com

CALL OR WRITE FOR OUR FREE 64 PAGE CATALOG!
(800) 445-3201

Digital Multimeters

Elenco Model M-1740

$39.95

11 Functions:
- Freq. to 20MHz
- Cap. to 20µF
- AC/DC Voltage
- AC/DC Current
- Beeper
- Diode Test
- Transistor Test
- Meets UL-1244 safety specs.

Model M-2760 - $24.95
(9 functions)

Elenco Model LCR-1810

$99.95

- Capacitance .1pF to 20µF
- Inductance 1µH to 20H
- Resistance .01Ω to 2000MΩ
- Temperature -20°C to 750°C
- DC Volts 0 - 20V
- Frequency up to 15MHz
- Diode/Audible Continuity Test
- Signal Output Function
- 3 1/2 Digit Display

Fluke 87III

$319

Features high performance AC/DC voltage and current measurement, frequency, duty cycle, resistance, conductance, and capacitance measurement.

CCTV Cameras

Cameras have 420 lines (360 color) of resolution, 0.08 Lux, 3.6mm/F2 90° field of view. Power requirement is 12VDC @ 100mA (order SC-1).

MONOCHROME CAMERAS

SC-12 - 35mm Lens (1.25"x1.25") $69
SC-15 - Pin Lens (1.25"x1.25") $69

Add $10 for lens • Add $10 for audio

Accessories:
SC-1 - 12V 100mA adapter $6.95
SC-2 - 50' cable with connectors $19.95

COLOR CAMERAS

SC-20 Pin Lens
SC-21 3.6mm Lens
360 Lines 1.25" x 1.25"
Infrared Sensitive, Audio Included
$109
Add $10 for case
Call for complete catalog.

Test Equipment

Quantity Discounts Available

Elenco Sweep Function Generator with built-in frequency counter Model GF-8036

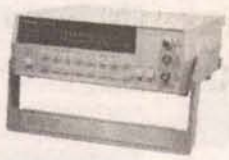
$229.95

This sweep function generator with counter is an instrument capable of generating square, triangle, and sine waveforms, and TTL, CMOS pulse over a frequency range from 0.2Hz to 2MHz.

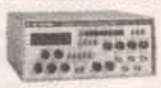
10 Function 1.3GHz Universal Counter Elenco Model F-1300

$229.95

- Frequency .05Hz - 1.3GHz 3 Ranges
- Period - Can read 60Hz to 60.000000 F=1/T
- Totalize - Counts to 199,999,999
- RPM - 3 to 2099994 RPM
- Duty Cycle
- Max/Min/AVG with Time
- Stop-watch set .2 sec. to 100 hrs.
- Math Functions
- Timer - 2 sec. to 99 days
- Pulse Width - 0.1ms to 66666.6ms



20MHz Sweep / Function Generator with Frequency Counter Model 4040



- 0.2Hz to 20MHz
- AM & FM modulation
- Burst Operation
- External Frequency counter to 30MHz
- Linear and Log sweep

$445

21.5MHz Model 4070	$1295
10MHz Model 4017	$325
5MHz Model 4011	$255

BK PRECISION

Elenco Handheld Universal Counter 1MHz - 2.8GHz Model F-2800

$99

Sensitivity:
- <1.5mV @ 100MHz
- <5mV @ 250MHz
- <5mV @ 1GHz
- <100mV @ 2.4GHz

Features 10 digit display, 16 segment and RF signal strength bargraph.

Includes antenna, NiCad battery, and AC adapter.

Elenco Quad Power Supply Model XP-581

4 Fully Regulated DC Power Supplies in One Unit

$85

4 DC voltages:
3 fixed: +5V @ 3A, +12V @ 1A, -12V @ 1A
1 Variable: 2.5 - 20V @ 2A

B&K Frequency Counter Model BK-1875

50Hz - 2.8GHz
3 Channels

$189

Sensitivity:
- <0.8mV @ 100MHz
- <6mV @ 300MHz
- <7mV @ 1GHz
- <100mV @ 3GHz

Ultra sensitive synchronous detector bargraph and RF strength.

B&K Video Monitor Tester Model 1275

$169

Great handheld unit to test PC and Mac monitors. The model 1275 is ideal for the field or the service bench. Small, portable and very effective, the 1275 generates crosshatch, dots, color bars and raster patterns in green, blue, red, black and white.

Soldering Station

Weller Low Cost Soldering Iron Model WLC-100

- Variable power control produces 5-40 watts.
- Ideal for hobbyists, DIYers and students.
- Complete with 40W iron.

$34.95

Elenco Oscilloscopes

Free Dust Cover and 2 Probes

S-1325	25MHz	Dual Trace	$325
S-1330	25MHz	Delayed Sweep	$439
S-1340	40MHz	Dual Trace	$475
S-1345	40MHz	Delayed Sweep	$569
S-1360	60MHz	Delayed Sweep	$749
S-1390	100MHz	Delayed Sweep	$995

DIGITAL SCOPE SUPER SPECIALS

DS-203	20MHz/10Ms/s Analog/Digital	$695
DS-303	40MHz/20Ms/s Analog/Digital	$995
DS-603	60MHz/20Ms/s Analog/Digital	$1295

Tekk Radios

Pro-Sport FRS Two-Way Radio Model PRO-SPORT+

Talk up to 2 miles!

Available in Yellow, Blue & Black

No License Required

- 1/2 Watt Output, 14 Channels.
- TX & RX LED/LCD Indicators.
- Large LCD Display.
- 38 Privacy (CTCSS) Tones.
- Removeable Antenna.
- Water Resistant.
- 500mW Output.
- Palm Sized.

$69 each or $125 Set of 2

PRO SPORT Model **$109.95** set of 2

PC Repair

A+ Certification Self-Study Course™
Model XK-305
$379

DOS/WIN Exam

DOS 6.2
Windows 3.1 Installation and Configuration
Windows 3.1 Application Support
Windows 3.1 Devices and Drivers
Windows 3.1 Networking and Troubleshooting
Windows 95 Installation and Deployment
Windows 95 Basic Configuration
Windows 95 Troubleshooting and Optimization

Includes all the technical material, knowledge and interactive exercises needed to pass the A+ exams and excel in the competitive PC repair marketplace.

Introduction to PC Repair Self-Study Course™
Model XK-301
$179

COURSE CONTENTS

Introduction to Computers
IBM PC's and Clones
PC Assembly/Disassembly
Introduction to MS-DOS
Introduction to Windows 3.1
Introduction to Windows 95
Introduction to Networks
Introduction to the Internet

Provides you with the easiest and most effective way to learn the fundamentals necessary for a profitable and successful career as a PC Repair Technician. Ideal for individuals new to the I.T. profession and as instruction prior to studying for A+ certification.

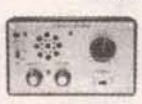
Elenco Technician Tool Kit Model TK-1500

$49.95

28 tools plus a DMM contained in a large flexible tool case with a handle ideal for everyone on the go.

Elenco Educational Kits

Model AR-2N6K



2 Meter / 6 Meter Amateur Radio Kit
$34.95

Model AM-780K

Two IC Radio Kit
$11.95

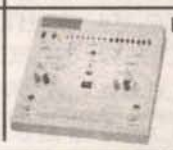
Model AK-700
Pulse/Tone Telephone Kit
$15.95

Model AK-870
Radio Control Car Kit
$24.95
- Solderless
- 7 Functions
- Radio Control Included

Model M-1005K
Digital Multimeter Kit
- 18 Ranges
- 3 1/2 Digit LCD
- Transistor Test
- Diode Test

$19.95

Model XK-150
Digital / Analog Trainer
$89.95



Guaranteed Lowest Prices

UPS SHIPPING: 48 STATES 5%
OTHERS CALL FOR DETAILS
IL Residents add 8.25% Sales Tax

SEE US ON THE WEB ——→ http://www.cs-sales.com

C&S SALES, INC.

150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX: (847) 541-9904 (847) 541-0710

VISA MasterCard DISCOVER

15 DAY MONEY BACK GUARANTEE

2 YEAR FACTORY WARRANTY

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Events CALENDAR

Continued from page 22

449.725/444.725 W1XM/R PL 114.8 (2A). Nick Altenbernd KA1MQX, 617-253-3776 (9-5). Web: http://web.mit.edu/w1mx/www/swapfest.html

MO - WASHINGTON - Hamfest. Zero Beaters ARC, Dave Neal N0PNG, 314-532-2477 (days) or 314-458-3254 (eve). E-Mail: Dave_Neal@msc.com Web: http://zbarc.usmo.com/

PA - KIMBERTON - Hamfest. Mid-Atlantic ARC, Bill Owen W3KRB, 610-325-3995. E-Mail: gem@op.net Web: http://www.marc.org/hamfest.html

JULY 22

NH - NASHUA - Hamfest. Res Ctr Church. NE Antique RC 617-923-2665

JULY 23

IL - SUGAR GROVE - Hamfest. Fox River Radio League, Maurice Schietecatte W9CEO, 815-786-2860. E-Mail: w9ceo@arrl.net Web: http://www.frrl.org/hamfest.html

JULY 29-30

OK - OKLAHOMA CITY - State Convention. Central OK Radio Amateurs, Harold Miller KB1ZQ, 405-672-7735 or 405-650-9963. E-Mail: n1lpn@swbell.net Web: http://www.geocities.com/heartland/7332

JULY 30

OH - RANDOLPH - Hamfest. Portage ARC, Joanne Solak KJ3O, 330-274-8240. E-Mail: ljsolak@apk.net Web: http://parc.portage.oh.us

AUGUST 2000

AUGUST 5

OH - COLUMBUS - Hamfest. Voice of Aladdin ARC, James Morton KB8KPJ, 614-846-7790. E-Mail: kb8kpj@cs.com

AUGUST 12

IL - QUINCY - Hamfest. Western Illinois ARC, Jim Funk, N9JF, 217-336-4191. E-Mail: jfunk@adams.net Web: http://www.qsl.net/w9awe

AUGUST 13

IA - AMANA - Hamfest. Cedar Valley ARC, Wayne Kolosik, KI0FE, 319-393-4224. E-Mail: ki0fe@usa.net

IN - GREENTOWN - Hamfest. Kokomo & Grant County ARCs, L.B. (Nick) Nickerson KA6NQW, 765-668-4814. E-Mail: ka6nqwnick@netusa1.net Web: http://www.netusa1.net/~ka6nqwnick/hamfest.html

NJ - BAYVILLE - Hamfest. Jersey Shore ARS, Bob Murdock WX2NJ, 732-269-6379. E-Mail: jsarsfest@aol.com Web: http://members.aol.com/jsarsfest/jsarsfest.html

AUGUST 20

MA - CAMBRIDGE - Flea at MIT. Albany and Main Sts. 9am-2pm. Talk-in: 146.52 & 449.725/444.725 W1XM/R PL 114.8 (2A). Nick Altenbernd KA1MQX, 617-253-3776 (9-5). Web: http://web.mit.edu/w1mx/www/swapfest.html

AUGUST 26-27

MA - BOXBORO - NE Division ARRL Convention. Dave W1TQ, 978-649-3907

AUGUST 27

IL - DANVILLE - Hamfest. Vermilion County ARA, Gary Denison KA9SKS, 217-759-7389. E-Mail: gdenison@danville.net

KS - SALINA - State Convention. Central KS ARC, Ron Tremblay WA0PSF, 785-827-8149. E-Mail: tremblay@midusa.net Web: http://www.qsl.net/w0cy

NY - YONKERS - Hamfest. Yonkers ARC, John Costa WB2AUL, 914-969-6548. E-Mail: wb2aul@aol.com

SEPTEMBER 2000

SEPTEMBER 9-10

FL - MELBOURNE - Hamfest. Platinum Coast ARS, Tim Madden KI4TG, 407-724-9339. E-Mail: ki4tg@hotmail.com

SEPTEMBER 16

NY - WHITE PLAINS - Hudson Division Convention. Westchester Emergency Communications Assn., Thomas Raffaelli WB2NHC, 914-741-6606. E-Mail: wb2nhc@weca.org Web: http://www.weca.org

SEPTEMBER 16-17

IL - PEORIA - Hamfest. Peoria Area ARC, Jim Williams N9HHU, 309-692-3378. E-Mail: jimn9hhu@juno.com Web: http://www.w9uvi.org

SEPTEMBER 17

MA - CAMBRIDGE - Flea at MIT. Albany and Main Sts. 9am-2pm. Talk-in: 146.52 & 449.725/444.725 W1XM/R PL 114.8 (2A). Nick Altenbernd KA1MQX, 617-253-3776 (9-5). Web: http://web.mit.edu/w1mx/www/swapfest.html

SEPTEMBER 23

NY - HAMBURG - Western NY ARRL Section Convention. Harold Smith K2HC, 716-424-7184 E-Mail: info@buffalohamfest.org Web: http://www.buffalohamfest.org

SEPTEMBER 24

NY - YONKERS - Flea Market. Lincoln High School, Kneeland Ave. 9am-3pm. VE Exams. Talk-in: 440.425 PL 156.7, 223.760 PL 67.0, 146.910, 443.350 PL 156.7. Metro 70cm Network, Otto Supliski WB2SLQ, 914-969-1053. E-Mail: wb2slq@juno.com Web: http://www.metro70cmnetwork.com

OH - CLEVELAND - Hamfest. Hamfest Association of Cleveland, Ron Nichols N8LZA, 1-800-CLE-FEST or 216-999-7388. E-Mail: info@hac.org Web: http://www.hac.org

OCTOBER 2000

OCTOBER 6-7

NH - ROCHESTER - Hamfest. Fairgrounds. Hoss Traders, Joe, 207-469-3492

OCTOBER 6-7-8

AZ - SCOTTSDALE - Southwestern Div. Convention. Scottsdale ARC, Walt Schuknecht N7IZM, 480-947-0338. E-Mail: n7izm@arrl.net

OCTOBER 15

MA - CAMBRIDGE - Flea at MIT. Albany and Main Sts. 9am-2pm. Talk-in: 146.52 & 449.725/444.725 W1XM/R PL 114.8 (2A). Nick Altenbernd KA1MQX, 617-253-3776 (9-5). Web: http://web.mit.edu/w1mx/www/swapfest.html

OCTOBER 21

NH - NASHUA - Hamfest. Res Ctr Church. NE Antique RC 617-923-2665

OCTOBER 29

NY - LINDENHURST - Hamfest. GSBARC & SCRC, Lenore Dunlop N2KYP, 516-785-0826. E-Mail: info@gsbarc.org Web: http://www.gsbarc.org

Roger's Systems Specialist

Celebrating 20 years in Business!!

24895 Avenue Rockefeller
Valencia California 91355

"We Have Great Connections"

Computer • Telecommunications
Network • Audio • Video

www.rogerssystems.com

Category 5 Patch Cable

TE-038-L5	3ft. Straight Patch	$1.75
TE-068-L5	7 ft. Straight Patch	$2.00
TE-128-L5	14ft. Straight Patch	$4.00
TE-258-L5	25ft. Staight Patch	$5.00
TE-358-L5	35ftt. Straight Patch	$7.00
TE-508-L5	50 ft. Straight Patch	$8.00
TE-758-L5	75ft. Straight Patch	$17.00
TE-108-L5	100 ft. Straight Patch	$16.00

Includes:
- One MiniView KVM switch
- 2 Sets of Premium Grade KVM Cables
- One PS/2 to AT keyboard adapter
- One PS/2 to Serial mouse adapter
- One User Guide

Features:
- Keyboard & mouse emulation for error
- No external power required
- Works virtually with any operating system
- Fully hot plugable

cat.no. DS-102-KMMPS

USB Cables

CC-USB-6	6ft. USB "A" to "A" M/M	$5.00
CC-USB-AB6	6ft. USB "A" to "B" M/M	$5.00
CC-USB-PP	6ft. USB to IEEE Printer Cable	$29.00
CC-USB-AB10	10ft.USB"A" to "B"M/M	$6.00
CC-USB-AB15	15ft.USB "A" to "B"M/M	$8.00
CC-USB-X10	10ft. USB Extension	$6.00

USB Accessories

CC-USB-8	USB (2) to 2x8 pin w/ Bracket	$5.00
CC-USB-9	USB (2) to 2x5 pin w/ Bracket	$5.00
USB-PCI	USB x2 PCI Add on Card	$27.00
USB-KB-104	USB 104-Key Kybrd Win98/PS2	$24.00
USB-MOUSE	3-Button USB Mouse 4200dpi	$12.00
USB-CAM	C-IT USB Cam w/ Software	$69.00

SCSI Ribbon Cables

NEW! TWISTED PAIR

CC-354	24" Ultra ATA 80C Dual IDE	$12.00
CC-355	SCSI Utra-2 68Pin T/P Ribbon	$16.00
CC-357	50" SCSI Utra-2 T/P 68 6devive	$29.00
CC-344	36" 50 Pin 2-device SCSI HDD	$1.00

Come to are Valencia Location

free gifts on Dec1st. — Dec.1st thur 4th — raffles — free food — door prizes

S-VGA COAXIAL CABLES

Extensions, male to female

CC-VGA-4C	6FT	$6.00
CC-VGA-5C	10FT	$8.00
CC-VGA-25CX	25FT	$16.00
CC-VGA-50CX	50FT	$28.00
CC-VGA-100CX	100FT	$44.00

Switch Box, male to male

CC-VGA-3C	6FT	$6.00
CC-VGA-9C	10FT	$8.00
CC-VGA-11C	25FT	$16.00
CC-VGA50MM	50FT	$28.00
CC-VGA100MM	100FT	$44.00

ADD ON CARDS

CA-PPGA-S1	PPGA Celeron CPU Slot 1 adaptor	$10.00
IO-398	ISA 8bit Single Parallel IEEE Card	$12.00
IO-400	PCI 32bit Single Parallel IEEE Card	$33.75
SP-884	16bit ISA Sound Card ESS Chip	$16.00
USB-PCI	USB x PCI Add on Card	$27.00
VD-466	S-VGA SIS 4MB PCI Video Card	$31.00
VD-481	ATI Rage IIC 2D/3D 8MB AGP Video Card	$44.00
VD-488	S3 Savage4 32MB AGP 12bit 3D Video Card	$99.00

- **$20.00 min. order required**
- Add $4.50 shipping for prepaid orders
- Prices subject to change without notice
- All major credit cards accepted
- Special offers only valid on items in stock
- California residents add tax
- Call for quanity discounts
- No out of state checks accepted

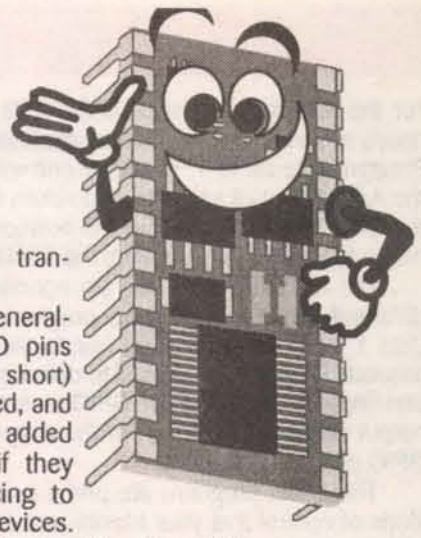
800-366-0579 661-295-5577 Fax 661-295-8777

Subscribe to Nuts & Volts Today!
Call 1-800-783-4624
and Use Your Visa or MasterCard.

Write in 62 on Reader Service Card.

STAMP APPLICATIONS

by Lon Glazner



Putting the Spotlight on BASIC Stamp Projects, Hints, and Tips

STAMP Net: A Multi-Drop Stamp-Based Network – Part II

Last month, we designed an RS-485 based network, and described a communication protocol, which allowed multiple BASIC Stamp2-SXs (BS2-SX) to communicate together. The communication was a Master-Slave format in which the Master would send a communication string to a specific Slave, causing that Slave to execute a specific program stored in memory. Once the program was executed, the Slave would respond with some data. This network was called STAMP Net.

Overview

Our previous design and testing was done on a solderless breadboard, which allowed enough flexibility to prove out the design concept. This month, the STAMP Net design was moved to a set of prototype PCBs, and the network communication was tested with cables measuring roughly 200 feet. From the literature I've read on RS-485, a 200-foot cable is small potatoes, as far as cable lengths go. And judging from the lack of trouble that I had getting the system to work, I'd have to agree.

Defining the Design

This design was defined pretty well in last month's article. I did decide to add a little code to control a 1A relay, and a pair of general-purpose I/O pins. Even with the addition of this functionality, there is plenty of room left in the BS2-SX to implement more functionality. I would really like to add a PC terminal interface to the design, but that will have to be done some time in the future, when time permits.

As a little refresher from last month, I've included the system block diagram. Figure 1 gives a pretty good conceptual overview how a Master-Slave communication protocol on an RS-485 network is connected. The RS-485 transceivers that were chosen for the design are the MAX487 from Maxim Integrated Circuits.

The changes in the schematic were pretty simple. A relay driver circuit was added. The relay is a 5V variety (drive voltage) which can handle 1A with a 30V potential at its switch connections. A 2N3904 NPN transistor buffers the BS2-SX pin that drives the relay, and a 1N4001 diode was added across the relay's inductor to reduce voltage spikes and other transients.

Two general-purpose I/O pins (GPIO, for short) were included, and should have added protection if they are interfacing to external devices. Take a look back at the Sept. '99 Stamp Applications article for more information on protecting I/O pins.

The GPIO pins can be set as inputs or outputs in software. The voltage level at either GPIO1 or GPIO2 will be returned to the Master unit if either pin is set as an input pin. As inputs, these pins could be used to read switches at each STAMP Net node. These same pins could be configured as outputs by a Master unit and be used to drive additional relays, or be used to light LEDs.

Reviewing Our Communication Protocol

The communication protocol was based on a generic structure of eight bytes for each communication string. The Master unit sends the address of the STAMP Net node that it was trying to communicate with, and the number of the program that it wishes to have executed. Five generic data bytes and a checksum byte follow the first two bytes. Table 1 can be used as a quick reference for the data string format for STAMP Net.

Byte	Number	Description
Address	1	Address of unit message is intended for
Program	2	Program to be executed by receiving unit
Data 1	3	General purpose data byte
Data 2	4	General purpose data byte
Data 3	5	General purpose data byte
Data 4	6	General purpose data byte
Data 5	7	General purpose data byte
Checksum	8	Sum of all bytes in message

Table 1: Command and Response String Definition

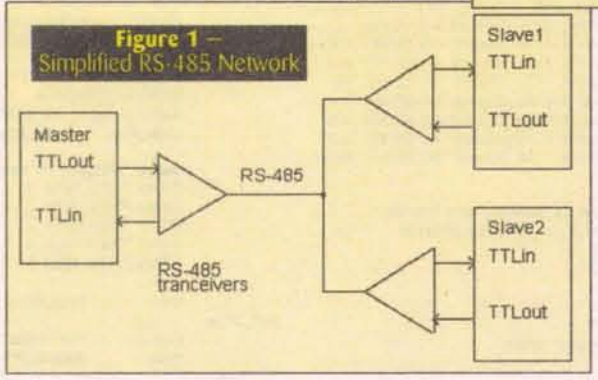


Figure 1 – Simplified RS-485 Network

As of now, there are only two programs that are loaded into the STAMP Net nodes for the Master unit to access through a Slave unit.

The first is the Analog.bsx program, which reads an eight-bit A/D and returns the average, maximum, and minimum measurements out of 128 samples.

PRINTED CIRCUIT BOARDS

QUALITY PRODUCT
FAST DELIVERY
COMPETITIVE PRICING

We will beat any competitor's prices!!!

10 pcs (3 days) 1 or 2 layers $249
10 pcs (5 days) 4 layers $695
(up to 30 sq. in. ea.) includes tooling, artwork, LPI mask & legend

* UL approved
* Single & Double sided
* Multilayers to 8 layer
* SMOBC, LPI mask
* Reverse Engineering
* Through hole or SMT
* Nickel & Gold Plating
* Routing or scoring
* Electrical Testing
* Artwork or CAD data
* *Fast* quotes

PROTOTYPE THROUGH PRODUCTION
PULSAR, INC
9901 W. Pacific Ave.
Franklin Park, IL 60131
Phone 847.233.0012
Fax 847.233.0013
Modem 847.233.0014
yogii@flash.net · flash.net/~yogii

SATELLITE TV – HACKERS 'BIBLE'!

The SECRETS are REVEALED!

- The principles of security
- Descrambler building blocks
- Smart cards, information wars & stupid mistakes
- Cracking codes (includes DirecTv source code)
- Installing and hooking up descramblers
- Video manipulative systems...and much more...

www.baylin.com
or... call 800-483-2423

ORDER via Internet or Send $60 plus $5 s/h to:
Baylin Publications, 1905 Mariposa, Boulder, CO 80302
MASTER,VISA & AMEX /COD orders accepted

576 pages, 6" x 8-1/2"
NEW!
5th Edition
Telephone: 303-449-4551
FAX: 303-939-8720

FREE CATALOG – Satellite TV books, videos and software

For the Master unit to receive the A/D data, it only needs to send a valid communication string with the Program byte set to 1. The Slave unit will interface to the A/D, take 128 samples, and return the results in the Data 1, Data 2, and Data 3 positions, and then return to waiting for data from the RS-485 bus.

The IOControl.bsx program operates a little bit differently than the Analog.bsx program. The value in Data 1 – when it is received from a Master unit that requests Program 2 – is used to determine the direction (input or output) of the GPIO pins, as well as the output voltages (0V or 5V) of the relay pin and any GPIO pins set as outputs.

These two programs are prime examples of the kinds of control that your Master unit can have over a Slave unit. The Master may execute a program in a Slave, and that program can be performed more or less autonomously. Or the Master may send data along with the program request information that reconfigures the Slave unit as in the IOControl.bsx program.

A communication protocol can have multiple timing requirements. I left the timing requirements for STAMP Net very lax. In fact, I extended the response time allotted for the Slave unit from 500ms to 1.5s since last month's article. I never intended to make STAMP Net a high-speed network, and some of the STAMP Net nodes that I'll be using will be monitoring environmental conditions, so additional time might be necessary.

So what does this all look like electrically? Oscilloscope captures of the Master and Slave communication are shown in Figure 4. Take a look at the data on the Master TX line (MST_TX), and how it is received on the Slave RX line (SLV_RX). The receive enable line is also of interest in this oscilloscope capture (MST_EN and SLV_EN). It is low to set the MAX487 IC to receive data, and high for the MAX487 to send data to the RS-485 bus (keep in mind that both the Master and Slave control their own MAX487). If you're having trouble with a communication protocol, "scoping" the signals like I've done here can detect the most common problems. The top signal, without a label, is scope channel

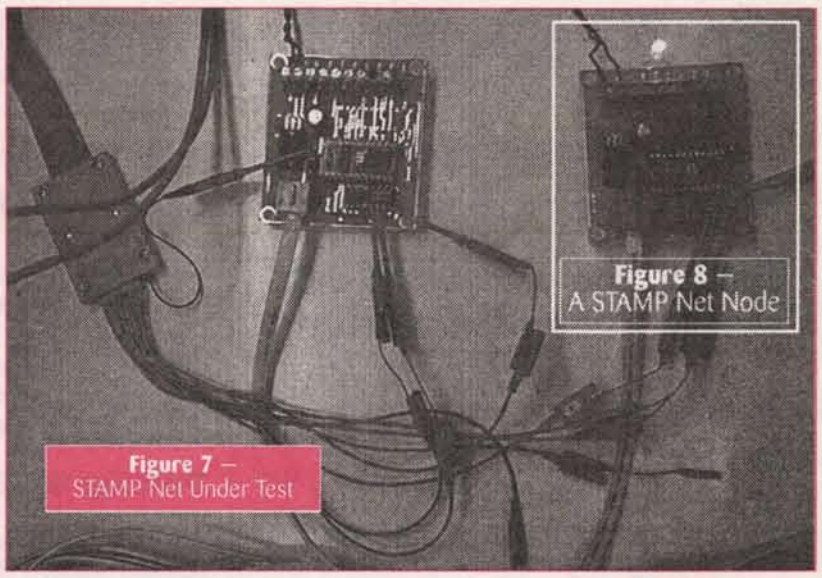


Figure 7 – STAMP Net Under Test

Figure 8 – A STAMP Net Node

Code Listing 1: Master.bsx

```
'*****************************************************************
'Master Program
'The Master program controls communication and data display. For a
'unit designated as a Master unit(addresss = 0) this program is
'used to poll the various slave units. If a unit is a Slave unit
'(address <> 0) then this program is where the unit waits for
'commands.
'
'{$STAMP BS2SX,C:\Parallax\Analog.bsx,C:\Parallax\IOControl.bsx}
'0:Master_Prgm.bsx

'I/O pin designations
AD_Clk          CON     0               'ADC0831 clock pin
AD_Dat          CON     1               'ADC0831 data pin
AD_CS           CON     8               'ADC0831 chip select (asserted low)
Relay           CON     9               'Relay control pin (asserted high)
GPIO1           CON     10              'General purpose I/O pin
GPIO2           CON     11              'General purpose I/O pin

'Communication Constants
Data_Out        CON     5               'TTL data out pin
TX_RX           CON     6               'Receive enable (asserted low)
Data_In         CON     7               'TTL data in pin
Baud            CON     45              '38.4kbps, 8N1 true data

'Internally used registers
Addr                    var     byte            'Address of unit
Comm_Flag       var     byte                    'flag bits for unit
        Mstr    var     Comm_Flag.bit0          'Set for Master unit cleared for Slave
        S1      var     Comm_Flag.bit1          'Set if Slave # 1 is present on RS-485 bus
        S2      var     Comm_Flag.bit2          'Set if Slave # 2 is present on RS-485 bus
        S3      var     Comm_Flag.bit3          'Set if Slave # 3 is present on RS-485 bus
        S4      var     Comm_Flag.bit4          'Set if Slave # 4 is present on RS-485 bus
        S5      var     Comm_Flag.bit5          'Set if Slave # 5 is present on RS-485 bus
        S6      var     Comm_Flag.bit6          'Set if Slave # 6 is present on RS-485 bus
        S7      var     Comm_Flag.bit7          'Set if Slave # 7 is present on RS-485 bus

'Communication message string variables bytes(8 total)
Addr_Req        var     byte                    'Unit address of message destination
Prgm_Req        var     byte                    'Request execution of this program
Dat1                    var     byte            'Data byte 1
Dat2                    var     byte            'Data byte 2
Dat3                    var     byte            'Data byte 3
Dat4                    var     byte            'Data byte 4
Dat5                    var     byte            'Data byte 5
Checksum        var     byte                    'Sum of previous bytes

'Storage Registers
Put_Addr                var     byte            'Put address location
Get_Addr                var     byte            'Get address location

'Working registers
Loop1                   var     byte            'For...Next variable
Work1                   var     byte            'General purpose register
Work2                   var     byte            'General purpose register
Work3                   var     byte            'General purpose register
Work4                   var     byte            'General purpose register
WorkBig                 var     word            'Word sized general purpose register

'A/D registers
ResultA_D       var     byte                    'Result of A to D measurement
MaxA_D                  var     byte            'Storage for maximum A to D result
MinA_D                  var     byte            'Storage for minimum A to D result
AvgA_D                  var     byte            'Storage for avg. A to D result

'Program constants
AD_Samples CON  128                             'Number of samples taken
DirFlag                 CON     6               'Flag set to skip direction setting routine

'*****************************************************************
Main_Program:

GET     DirFlag,Work2
If Work2 = 10 Then Get_Address

Comm_Flag  = %00000000
Outs                    = %0000000100100000             'Set output pin values
Dirs                    = %0000001101100011             'Set pin direction values

Get_Address:
Addr    = (IN&%0011100)/4                       'Get unit address from P4-2
If Addr <> 0 then No_Master
        Mstr = 1
No_Master:
'Pause                  2000

'Addr and Comm Flag register Debug statements
'Debug      "Address = ", BIN8 Addr,CR
'Debug      "Comm Flag = ", BIN8 Comm_Flag,CR

If Mstr = 1 then Master_Program
        Goto    Slave_Program

'*****************************************************************
Master_Program:

        Pause                   1000
        Addr_Req    = 1                         'Contact unit 1
        Prgm_Req    = 2                         'Request IOControl Program
        Dat1                    = %11100100     'GPIO1 = out-high GPIO2 = input Relay = on

        Checksum    = Addr_Req+Prgm_Req+Dat1+Dat2+Dat3+Dat4+Dat5
        HIGH                    Data_Out        'Set output high
        HIGH                    TX_RX           'Enable transmission on RS-485
        SEROUT      Data_Out,Baud,[Addr_Req,Prgm_Req,Dat1,Dat2,Dat3,Dat4,Dat5,Checksum]
        PAUSE                   1
        LOW                     TX_RX           'Enable receiver on RS-485
        SERIN
Data_In,Baud,1500,No_Data,[Work1,Work2,Dat1,Dat2,Dat3,Dat4,Dat5,Checksum]
                                                'Test checksum
        Work4       = Work1+Work2+Dat1+Dat2+Dat3+Dat4+Dat5
        If Work4 <> Checksum Then Bad_Data
                                                'Set flag for unit that responds
        Comm_Flag = 1
        Work3 = %00000001                       'Set up pointer bit
        Work3 = Work3 << Addr_Req               'Rotate "1" into Slave location
        Comm_Flag  = Comm_Flag+Work3            'Add pointer bit to to designate active Slave
                                                'Display incoming data
        Debug "Address of Sender = ",DEC Addr_Req,CR
        Debug "Data byte 1      = ",DEC Dat1,CR
        Debug "Data byte 2      = ",DEC Dat2,CR
        Debug "Data byte 3      = ",DEC Dat3,CR
        Debug "Data byte 4      = ",DEC Dat4,CR
        Debug "Data byte 5      = ",DEC Dat5,CR

        Goto    Done_Polling
Bad_Data:
        Debug   "Checksum Invalid Addr: ",DEC Addr_Req,cr
        Goto    Master_Program
No_Data:
        Debug   "No Data Returned Addr: ",DEC Addr_Req,cr
        Goto    Master_Program
Done_Polling:
        Debug   "Comm_Flag = ", BIN8 Comm_Flag,CR
'       Pause           3000
        Goto    Master_Program


'*****************************************************************
Slave_Program:
        Debug   "Slave Program ",CR
        LOW             TX_RX                   'Enable receiver on RS-485
        SERIN           Data_In,Baud,[Addr_Req,Prgm_Req,Dat1,Dat2,Dat3,Dat4,Dat5,Checksum]
                                                'Test checksum
        If Addr_Req <> Addr Then Bad_Address
        Work4   = Addr_Req+Prgm_Req+Dat1+Dat2+Dat3+Dat4+Dat5
        If Work4 <> Checksum Then Bad_Sum
        PUT             0,Dat1                  'Store data for other programs
        PUT             1,Dat2
        PUT             2,Dat3
        PUT             3,Dat4
        PUT             4,Dat5
        RUN             Prgm_Req                'Execute requested program
Bad_Sum:
        Debug   "Checksum Invalid: ",cr
        Goto    Slave_Program
Bad_Address:
        Debug   "Wrong Address: ",DEC Addr_Req,cr
        Goto    Slave_Program

        Goto    Get_Address
END
```

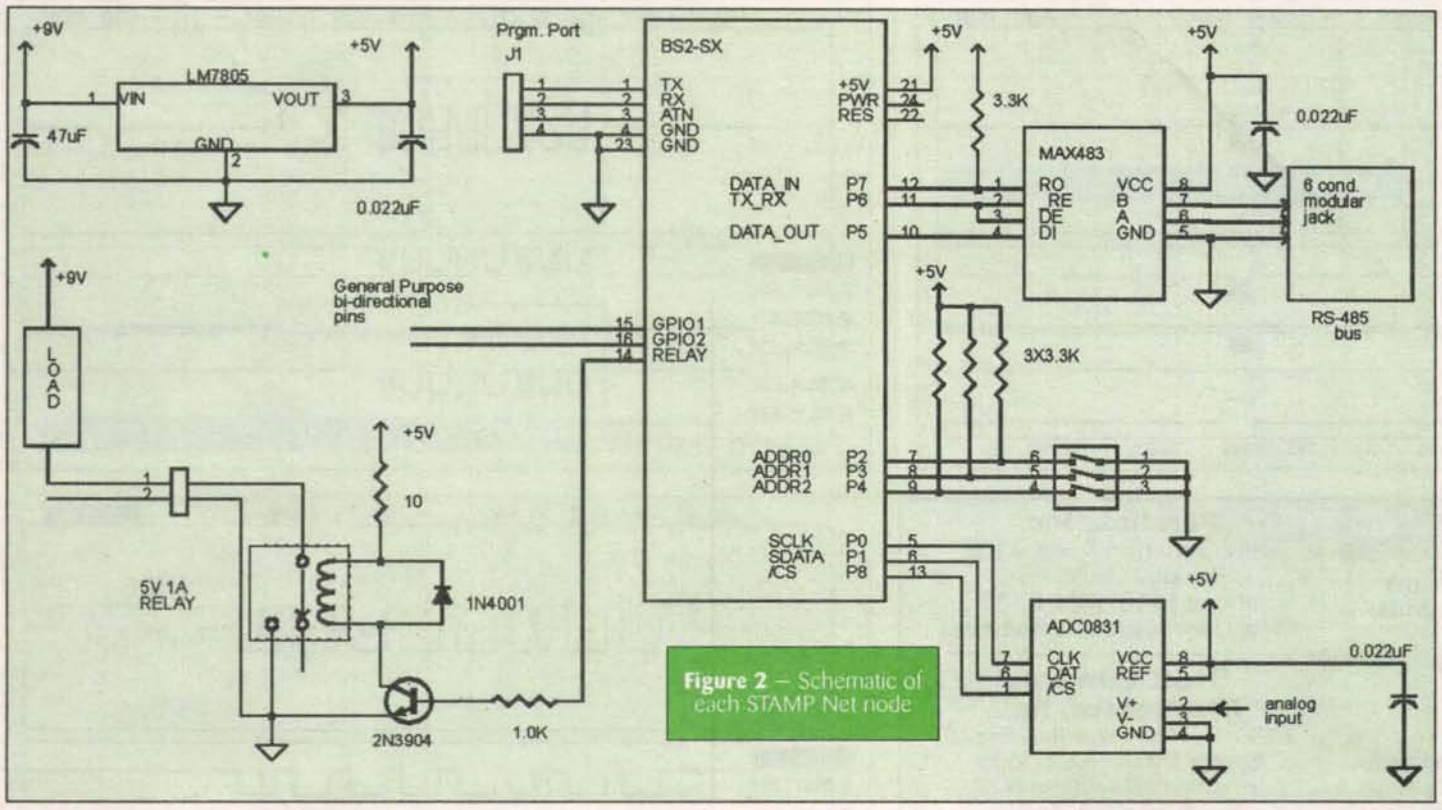


Figure 2 – Schematic of each STAMP Net node

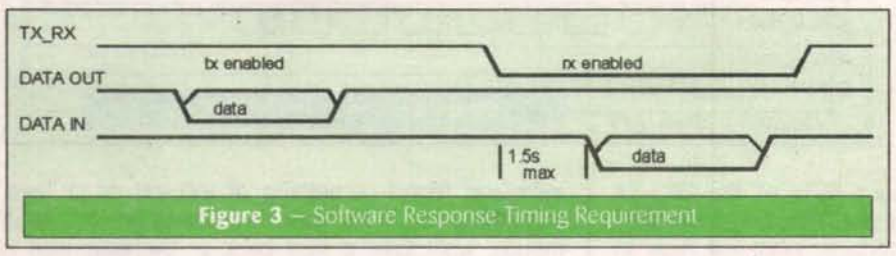


Figure 3 – Software Response Timing Requirement

A1–A2, which is the differential voltage as seen by the MAX487.

Zooming in on the Master unit transmission gives us some additional insight into what's really going on. It is also nice to get a close-up of the Slave unit response, as shown in Figure 6.

The Software

There are a few differences between the Master.bsx and Analog.bsx programs from last month. I added a couple of lines of code which allowed me to skip the I/O direction setting lines of the code if the IOControl.bsx program had been executed. This prevents the Slave unit from resetting the direction of the GPIO pins, or their output voltage levels when the Slave returns to the main program after IOControl.bsx is executed.

I also removed the part of the Master.bsx routine which polled each Slave on the STAMP Net. This function will be replaced later by a user interface, and a more in-depth polling routine. I have added the new versions of the programs here for anyone that may wish to see them. For these programs, the Slave address and Program request byte should be entered into the Master part of the Master.bsx program. This makes testing new programs a little simpler.

In Closing

At this point, I've got a pretty good head of steam going on the STAMP Net project. The PCBs are designed and look like they'll work for the final application, which is a workshop alarm. Although, I've got to say, there is still a lot of software to write. The three programs listed here need to be refined, and I'm sure I've got a little learning to do. But, with the BS2-SX, I have plenty of room for code, and the Parallax technical support is only an E-Mail away.

Code Listing 2: Analog.bsx

```
'Analog.bsx
'This is program 1 for the STAMP Net design. If this program
'is requested then 128 analog measurements are taken with the
'ADC0831 analog to digital converter. The maximum, minimum,
'and average result are returned to the Master unit.

'I/O pin designations
AD_Clk          CON     0               'ADC0831 clock pin
AD_Dat          CON     1               'ADC0831 data pin
AD_CS           CON     8               'ADC0831 chip select (asserted low)
Relay           CON     9               'Relay control pin (asserted high)
GPIO1           CON     10              'General purpose I/O pin
GPIO2           CON     11              'General purpose I/O pin

'Communication Constants
Data_Out        CON     5               'TTL data out pin
TX_RX           CON     6               'Receive enable(asserted low)
Data_In         CON     7               'TTL data in pin
Baud            CON     45              '38.4kbps, 8N1 true data

'Internally used registers
Addr            var     byte            'Address of unit
Comm_Flag var   byte                    'flag bits for unit
        Mstr    var     Comm_Flag.bit0  'Set for Master unit cleared for Slave
        S1      var     Comm_Flag.bit1  'Set if Slave # 1 is present on RS-485 bus
        S2      var     Comm_Flag.bit2  'Set if Slave # 2 is present on RS-485 bus
        S3      var     Comm_Flag.bit3  'Set if Slave # 3 is present on RS-485 bus
        S4      var     Comm_Flag.bit4  'Set if Slave # 4 is present on RS-485 bus
        S5      var     Comm_Flag.bit5  'Set if Slave # 5 is present on RS-485 bus
        S6      var     Comm_Flag.bit6  'Set if Slave # 6 is present on RS-485 bus
        S7      var     Comm_Flag.bit7  'Set if Slave # 7 is present on RS-485 bus

'Communication message string variables bytes(8 total)
Addr_Req  var   byte                    'Unit address of message destination
Prgm_Req  var   byte                    'Request execution of this program
Dat1            var     byte            'Data byte 1
Dat2            var     byte            'Data byte 2
Dat3            var     byte            'Data byte 3
Dat4            var     byte            'Data byte 4
Dat5            var     byte            'Data byte 5
Checksum  var   byte                    'Sum of previous bytes

'Storage Registers
Put_Addr        var     byte            'Put address location
Get_Addr        var     byte            'Get address location

'Working registers
Loop1           var     byte            'For...Next variable
Work1           var     byte            'General purpose register
Work2           var     byte            'General purpose register
Work3           var     byte            'General purpose register
Work4           var     byte            'General purpose register
WorkBig         var     word            'Word sized general purpose register

'A/D registers
ResultA_D  var  byte                    'Result of A to D measurement
MaxA_D          var     byte            'Storage for maximum A to D result
MinA_D          var     byte            'Storage for minimum A to D result
AvgA_D          var     byte            'Storage for avg. A to D result

'Program constants
AD_Samples CON  128                     'Number of samples taken
DirFlag         CON     6               'Flag set to skip direction setting routine

'*****************************************************************
Main_Program:

GET     DirFlag,Work2
If Work2 = 10 Then Get_Address

Comm_Flag  = %00000000
Outs            = %0000000100100000     'Set output pin values
Dirs            = %0000001101100011     'Set pin direction values

Get_Address:
Addr    = (INL&%0011100)/4              'Get unit address from P4-2

        WorkBig = 0                     'Clear average storage register
        MinA_D  = 255                   'Set minimum to max output
        MaxA_D  = 0                     'Set maximum to min output

Measure_Analog:
        For Loop1 = 1 to AD_Samples
                LOW             AD_CS
                PULSOUT AD_Clk,10
                SHIFTIN AD_Dat,AD_Clk,msbpost,[ResultA_D]
                HIGH            AD_CS
                WorkBig = Workbig + ResultA_D
                If ResultA_D < MaxA_D Then Test_Min
                        MaxA_D = ResultA_D
Test_Min:
                If ResultA_D > MinA_D Then Keep_Sampling
                        MinA_D = ResultA_D
Keep_Sampling:
        Next
        AvgA_D = WorkBig/AD_Samples

Debug   "Average Storage = ",DEC WorkBig,cr
Debug   "Minimum A to D = ",DEC MinA_D,cr
Debug   "Maximum A to D = ",DEC MaxA_D,cr

        Checksum = MaxA_D+MinA_D+AvgA_D
        HIGH            Data_Out        'Set output high
        HIGH            TX_RX           'Enable transmission on RS-485
        SEROUT  Data_Out,Baud,[$00,$00,MaxA_D,MinA_D,AvgA_D,$00,$00,Checksum]
        PAUSE           1
        LOW             TX_RX           'Enable receiver on RS-485

        RUN     0                       'Return to main program
END
```

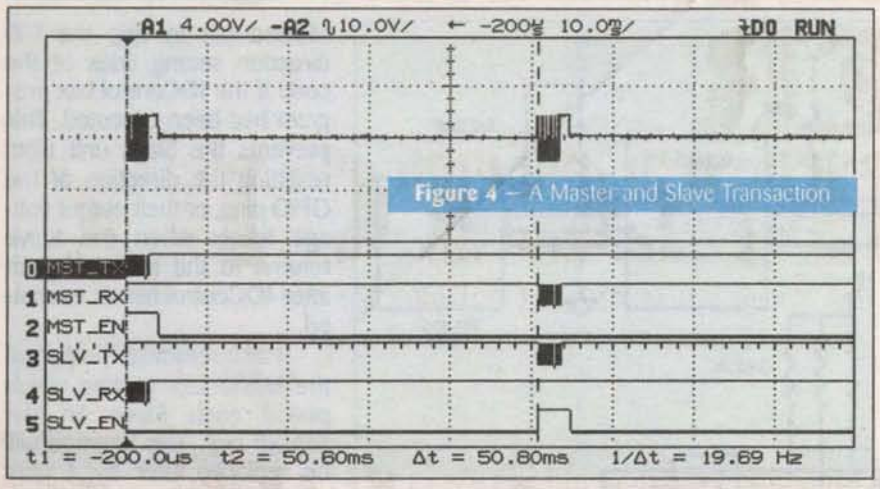


Figure 4 – A Master and Slave Transaction

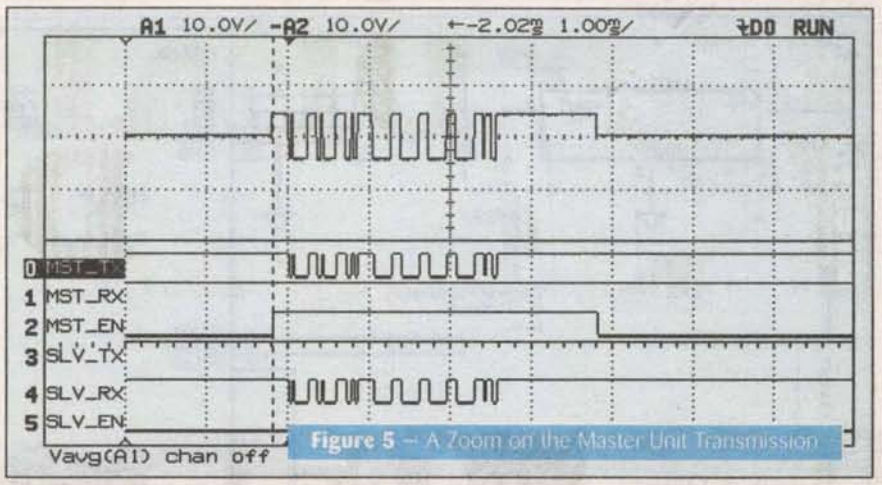


Figure 5 – A Zoom on the Master Unit Transmission

RESOURCES

For more information on the BASIC Stamp, contact:

Solutions Cubed
Lon Glazner
3029 Esplanade Suite F
Chico, CA 95973
E-Mail: **lon@solutions-cubed.com**
www.solutions-cubed.com
Phone: **530-891-8045**
Fax: **530-891-1643**

Parallax, Inc.
3805 Atherton Road, #102
Rocklin, CA 95765
phone **(916) 624-8333**
http://www.parallaxinc.com

Scott Edwards Electronics, Inc.
1939 S. Frontage Rd. Ste. F
Sierra Vista, AZ 85635
phone **520-459-4802**
fax **520-459-0623**
www.seetron.com info@seetron.com

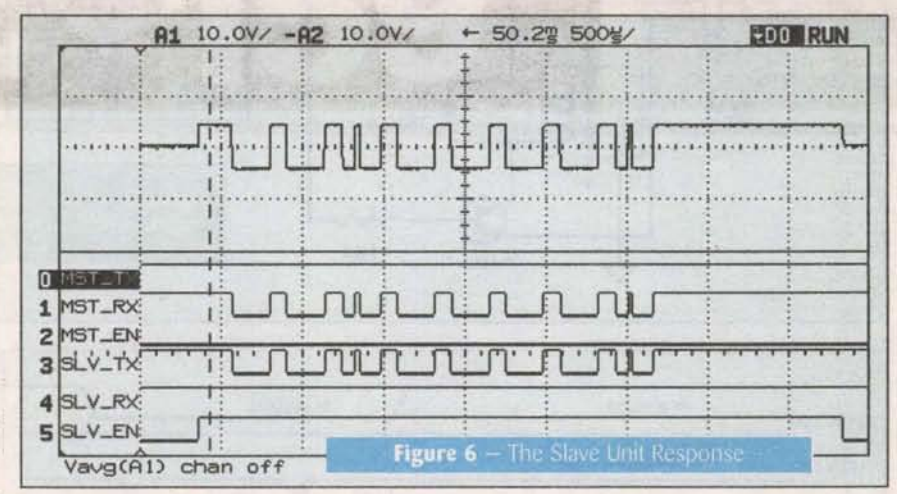


Figure 6 – The Slave Unit Response

The RS-485 network went together without much trouble, and termination resistors were avoided (thanks to short cable requirements). This is not always the case. I think I stacked the deck in my favor by taking a realistic approach to what I wanted my network to do. The generic STAMP Net communication protocol prevented me from getting bogged down in timing issues, or overly elaborate code requirements. Keeping cables short (no run over 200 feet long) kept expenses down, and electrical reflections under control.

Probably the best news is that I've got about 80% of the BS2-SX resources still available for use. That could translate into a pretty cool user interface. We'll just have to wait and see.

But that's it for STAMP Net in this forum. I hope everyone found something of interest or at least something useful for your own Stamp project. Next month, we'll take a step back to the past with a BASIC Stamp 1 and a 12-bit A/D interface. See you then. **NV**

Code Listing 3: IOControl.bsx

```
'IOControl
'The IOControl program sets the pin direction and output levels of the Relay,
'GPIO1, and GPIO2 pins. The pin direction and voltage level are determined
'by the value in Dat1 sent by the Master unit.
'
'The values are defined as,
'         Dat1,2     GPIO1 direction 1 = output
'         Dat1,3     GPIO2 direction 1 = output
'         Dat1,5     Relay voltage level
'         Dat1,6     GPIO1 voltage level
'         Dat1,7     GPIO2 voltage level

'I/O pin designations
AD_Clk              CON       0                 'ADC0831 clock pin
AD_Dat              CON       1                 'ADC0831 data pin
AD_CS               CON       8                 'ADC0831 chip select (asserted low)
Relay               CON       9                 'Relay control pin (asserted high)
GPIO1               CON       10                'General purpose I/O pin
GPIO2               CON       11                'General purpose I/O pin

'Communication Constants
Data_Out            CON       5                 'TTL data out pin
TX_RX               CON       6                 'Receive enable(asserted low)
Data_In             CON       7                 'TTL data in pin
Baud                CON       45                '38.4kbps, 8N1 true data

'Internally used registers
Addr                var       byte              'Address of unit
Comm_Flag  var      byte                        'flag bits for unit
           Mstr     var       Comm_Flag.bit0    'Set for Master unit cleared for Slave
           S1       var       Comm_Flag.bit1    'Set if Slave # 1 is present on RS-485 bus
           S2       var       Comm_Flag.bit2    'Set if Slave # 2 is present on RS-485 bus
           S3       var       Comm_Flag.bit3    'Set if Slave # 3 is present on RS-485 bus
           S4       var       Comm_Flag.bit4    'Set if Slave # 4 is present on RS-485 bus
           S5       var       Comm_Flag.bit5    'Set if Slave # 5 is present on RS-485 bus
           S6       var       Comm_Flag.bit6    'Set if Slave # 6 is present on RS-485 bus
           S7       var       Comm_Flag.bit7    'Set if Slave # 7 is present on RS-485 bus

'Communication message string variables bytes(8 total)
Addr_Req   var      byte                        'Unit address of message destination
Prgm_Req   var      byte                        'Request execution of this program
Dat1                var       byte              'Data byte 1
Dat2                var       byte              'Data byte 2
Dat3                var       byte              'Data byte 3
Dat4                var       byte              'Data byte 4
Dat5                var       byte              'Data byte 5
Checksum   var      byte                        'Sum of previous bytes

'Storage Registers
Put_Addr            var       byte              'Put address location
Get_Addr            var       byte              'Get address location

'Working registers
Loop1               var       byte              'For...Next variable
Work1               var       byte              'General purpose register
Work2               var       byte              'General purpose register
Work3               var       byte              'General purpose register
Work4               var       byte              'General purpose register
WorkBig             var       word              'Word sized general purpose register

'A/D registers
ResultA_D  var      byte                        'Result of A to D measurement
MaxA_D              var       byte              'Storage for maximum A to D result
MinA_D              var       byte              'Storage for minimum A to D result
AvgA_D              var       byte              'Storage for avg. A to D result

'Program constants
AD_Samples CON      128                         'Number of samples taken
DirFlag             CON       6                 'Flag set to skip direction setting routine

'*****************************************************************
Main_Program:

GET         DirFlag,Work2
If Work2 = 10 Then Get_Address

Comm_Flag  = %00000000
Outs                = %0000000100100000         'Set output pin values
Dirs                = %0000001101100011         'Set pin direction values

Get_Address:
Addr       = (INL&%00011100)/4                  'Get unit address from P4-2

'Set I/O Direction
           GET                  0,Work1         'Dat1 from Mater stored in RAM0
           Work1.NIB0 = Work1.NIB0&%1100        'Clear 2 low bits of desired dir. reg.
           Work2.NIB0 = DIRC&%0011              'Clear 2 high bits of actual dir. reg.
           DIRC                 = Work2.NIB0+Work1.NIB0 'Sum of high and low bits is direction
           DEBUG      "DIRC     = ",BIN4 DIRC,CR 'Display direction nibble

'Set output levels
           GET                  0,Work1         'Dat1 from Master stored in RAM0
           Work1.NIB1 = Work1.NIB1&%1110        'High nibble has voltage levels
           OUTC                 = Work1.NIB1    'Set output levels
           DEBUG      "OUTC     = ",BIN4 OUTC,CR 'Display output register

           Dat1                 = 0             'Clear returned data
           If DIRC    = %1111 Then No_Inputs    'If direction = %1111 then skip
                      Dat1      = INC&%1100     'Dat1 equals values at GPIO1,2
           DEBUG      "INC      = ",BIN4 INC,CR 'Display input values

No_Inputs:                                      'Send data to Master
           Checksum   = Dat1
           HIGH                 Data_Out        'Set output high
           HIGH                 TX_RX           'Enable transmission on RS-485
           SEROUT     Data_Out,Baud,[$00,$00,Dat1,$00,$00,$00,$00,Checksum]
           PAUSE                1
           LOW                  TX_RX           'Enable receiver on RS-485

           PUT                  DirFlag,10
           RUN                  0               'Return to main program
END
```

dealer directory dealer directory dealer directory

HOW TO PLACE A CLASSIFIED AD

TYPE or PRINT your **ELECTRONICALLY RELATED** ad copy **CLEARLY (not all caps)** on a separate piece of paper. Spell out words when submitting handwritten copy. Calculate the number of words and multiply it by the appropriate rate (see RATE PER WORD section). Include any charges for **bold** and/or CAPPED words, any artwork costs that would be applicable, and/or costs for boxing your ad (explained below). Choose the appropriate classification for your ad(s) to appear in (see below). If no classification is indicated, it will be placed in Misc. Electronics or wherever we deem most suitable. **Enclose your name, address, phone number, and *Nuts & Volts* account number from your mailing label** (if available) for identification purposes. Include full payment — **CLASSIFIEDS RUN ON A PRE-PAID BASIS ONLY** — and mail your completed order to:

NUTS & VOLTS MAGAZINE, 430 Princeland Ct., Corona, CA 92879.

RATE PER WORD

The ad rate for **current PAID subscribers** is **60¢** per word. All others pay **$1.20** per word. There is a **$9.00 minimum** charge per ad per insertion.

WORDS IN BOLD AND/OR ALL CAPS

Words to be set in **bold** or CAPS are each 10¢ extra PER WORD. **BOLD CAPS** are 20¢ extra per word. The first two words of each ad are bold capped at no charge. Indicate bold words by underlining. Words normally written in caps (e.g., IBM) and accepted abbreviations such as VAC or MHz are NOT charged as all cap words. Use a two-letter abbreviation for states.

PHOTOS, DRAWINGS, AND BOXES

A photo or drawing may be run at the top of your classified ad for an additional **$10.00** (1" depth max.) for camera-ready art. No wording is allowed in this area. Add a one-time charge of **$5.00** to enlarge, reduce, or duplicate line art, or **$8.00** for halftone of photographs. To **BOX** your ad, include an additional **$50.00** for copy-only ads, or **$75.00** for ads with art or photos.

FAXING IN AD COPY

You may fax in ad copy or changes before the closing date (5:00pm on the **5th**) at 909-371-3052 using MasterCard or Visa. Include credit card expiration date, the name that appears on the card, a daytime phone number, and your *Nuts & Volts* account number. Ads without credit card information will not be listed as received until payment is received in full. **WE DO NOT CALL OR FAX BACK VERIFICATION OR QUOTES OF FAXED-IN ADS.** For verification of faxed-in ads, please call 909-371-8497.

DEADLINE

Prepaid ads received by 5:00pm on the **closing date (5th of the month)** will appear in the following month's issue. Ads postmarked through the **5th**, but received after the closing date, will be placed in the next available issue. No cancellations or changes after the 5th. Cancellations and changes must be submitted in writing.

IMPORTANT INFORMATION

All classified ads are running copy only. No special positioning, centering, dot leaders, extra space, etc. is allowed. All advertising in *Nuts & Volts* is limited to **electronically related items ONLY**. All ads are subject to approval by the publisher. We reserve the right to reject or edit any ad submitted. We do not take ad copy or changes over the phone. We do not bill for classified ads. Repeat ads or ads run in multiple classifications within the same issue are allowed. Paid subscribers may run ads at the 60¢ rate only through their subscription expiration date. **NO REFUNDS**. Credit only. No credit for typesetting errors will be issued unless you *clearly* print or type your ad copy.

Choose a category for your ad from the classifications listed below.

10. Ham Gear For Sale
20. Ham Gear Wanted
30. CB/Scanners
40. Music & Accessories
50. Computer Hardware
60. Computer Software
70. Computer Equipment Wanted
80. Test Equipment
85. Security
90. Satellite Equipment
95. Military Surplus Electronics
100. Audio/Video/Lasers
110. Cable TV
115. Telephone/Fax
120. Components
125. Microcontrollers
130. Antique Electronics
135. Aviation Electronics
140. Publications
145. Robotics
150. Plans/Kits/Schematics
155. Manuals/Schematics Wanted
160. Misc. Electronics For Sale
170. Misc. Electronics Wanted
175. BBS & Online Services
180. Education
190. Business Opportunities
200. Repairs/Service

ADVERTISER'S INDEX

Abacom Technologies 63
ABC Electronics 40
ACP Super Store 46
ActiveWire, Inc. 70
Advanced Transdata Corporation 21,35
AK Peters 61
Alfa Electronics 40
All Electronics Corporation 56
Allison Technology Corporation 63
Alltech Electronics 53
Alltronics 31
Andromeda Research 22
Antique Radio Classified 69
AST Global Electronics 84
Astro Too 69
Aventrade 68
Baylin Publications 73
Bilocon Corp. 69
Bitz Technology 68
C & S Sales, Inc. 70
C and H Sales Company 55
Chicago Circuits Corporation 53
Circuit Specialists, Inc. 94
Communication Surplus 68
Consumertronics 40
Corby 91
Corporate Systems Center 2, 95
Cunard Associates 57
Decade Engineering 70
DeMar Electronics 69
DesignNotes.com 30
Digital Products Company 70
Direct Factory Supply, Inc. 27
Diverse Electronic Services 69
DMD Systems Recovery, Inc. 69
Earth Computer Technologies 58
EDS 55
E.H. Yost & Co. 16
Electro Mavin 87
Electro Science Applications, Inc. 86
Electro Tool, Inc. 59
Electronic Products 70
Electronix Express 39
EMAC, Inc. 91
EPS 69
Equipment Management Technology 52
Excess Solutions 54
ExpressPCB 47
Fair Radio Sales 27
Foss Warehouse Distributors 68
Fusion Electronic Security 35
Gateway Electronics, Inc. 38
General Device Instruments 68
Gibraltar Trade Center, Inc. 60
Globaltech Distributors 70
Graymark 92
Halted Specialties Co. 3
Howard Electronics 20
H.T. Orr Computer Supplies 59
Hyatt Electronics 89
Information Unlimited 34
Inkjet Southwest 36
Intek Electronic Systems 47
intelligence 69
Intronics, Inc. 59
Intuitive Circuits LLC 16
Jade Products, Inc. 68
Jameco Electronics 45
Jam RF 52
J. J. Hill 68
Junkware.com 70
J-Works, Inc. 88
La Paz Electronics Int'l. 59
Lemos International Co., Inc. 67
Levy Latham 47
Linear Systems 11
Lynxmotion, Inc. 22
M2L Electronics 62
Matco, Inc. 69-70
MCM Electronics 19
Meredith Instruments 35
Metric Equipment Sales, Inc. 67
microEngineering Labs 11
Micromint 17
Midland Technologies 70
Milestone Products 23
Modern Communications 30
Mr. NiCd 16
MSC Electronics 69
Netcom 25
Norcomm 24
Ontrak Control Systems 68
Optoelectronics 4
OS Systems 88
Parallax, Inc. .... Back Cover
PARAMAX, INC. 85
PCB Express, Inc. 69
PCW, Inc. 46
Phelps Instruments 86
Pioneer Hill Software 54
Polaris Industries 15
Power Quality, Inc. 68
Prairie Digital, Inc. 69
PTL Test Equipment, Inc. 39
Pulsar, Inc. 73
Quality Kits 70
R & S Surplus 83
Ramsey Electronics, Inc. 37
R.E. Smith 70
Resources Un-Ltd. 42
Risk Free Disks, Inc. 69
Roger's Systems Specialist 72
Saelig Company 24
Sam's Electronics 84
Scott Edwards Electronics, Inc. 28
Seabird Technical 69
Shreve Systems 44
SiGEM 70
Skycraft Parts & Surplus, Inc. 59
Square 1 Electronics 13
SuperCircuits 82
Surplus Traders 68
Techniks, Inc. 70
Technological Arts 62
Technology Electronics, Ltd. 68
Telulex, Inc. 81
Test Equipment Plus 59
The RF Connection 11
Timeless Products 58
Timeline, Inc. 61
TNT Electronics 89
Tropical Hamboree 85
Tucker Electronics 29
Ultralink 70
Unicorn Electronics 28
Upstate Games 69
USI Corp. 14
V&V Mach. & Equipment, Inc. 68-70
Velleman 41
Vesta Technology, Inc. 70
Visitect, Inc. 60
Weeder Technologies 87
Western Test Systems 32-33

AMATEUR RADIO & TV

Alltronics 31
Astro Too 69
Communication Surplus 68
Gateway Electronics, Inc. 38
Jade Products, Inc. 68
Lemos International Co., Inc. 67
Matco, Inc. 69-70
Norcomm 24
Ramsey Electronics, Inc. 37
The RF Connection 11

ASSEMBLY SERVICES

Bilocon Corp. 69

BATTERIES/CHARGERS

Aventrade....68
Cunard Associates 57
E.H. Yost & Co. 16
Globaltech Distributors 70
Jade Products, Inc. 68
Mr. NiCd....16
Power Quality, Inc. 68

BUSINESS OPPORTUNITIES

Corby 91
Intek Electronic Systems 47
J. J. Hill 68

BUYING ELECTRONIC SURPLUS

ABC Electronics....40
Alltech Electronics 53
C and H Sales Company 55
Diverse Electronic Services 69
Earth Computer Technologies 58
EPS 69
Equipment Management Technology 52
Excess Solutions 54
Intek Electronic Systems 47
Metric Equipment Sales, Inc. 67
Roger's Systems Specialist 72
Skycraft Parts & Surplus, Inc. 59
Timeline, Inc. 61

CABLE TV

Direct Factory Supply, Inc. 27
Foss Warehouse Distributors 68
Milestone Products 23
Modern Communications....30
PCW, Inc. 46
Sam's Electronics 84
Timeless Products 58
TNT Electronics 89

CB/SCANNERS

USI Corp. 14

CCD CAMERAS/VIDEO

Circuit Specialists, Inc. 94
Decade Engineering 70
Fusion Electronic Security 35
Matco, Inc. 69-70
MSC Electronics 69
Polaris Industries 15
Ramsey Electronics, Inc. 37
Resources Un-Ltd. 42
Seabird Technical 69
SuperCircuits 82
Timeline, Inc. 61
USI Corp. 14

COMPONENTS

Chicago Circuits Corporation....53
Communication Surplus 68
Electronic Products 70
Electronix Express 39
EPS 69
Excess Solutions 54
Hyatt Electronics 89
Jameco Electronics 45
La Paz Electronics Int'l. 59
Linear Systems....11
OS Systems 88
Pulsar, Inc. 73
SiGEM 70
Skycraft Parts & Surplus, Inc. 59
Unicorn Electronics 28
Visitect, Inc. 60

COMPUTER

Hardware

ACP Super Store 46
ActiveWire, Inc. 70
Allison Technology Corp. 63
Alltech Electronics 53
Consumertronics....40
Corporate Systems Center 2, 95
DMD Systems Recovery, Inc. 69
Earth Computer Technologies 58
Electro Mavin....87
General Device Instruments 68
Gibraltar Trade Center, Inc. 60
Halted Specialties Co. 3
Jameco Electronics 45
La Paz Electronics Int'l. 59
MCM Electronics 19
Risk Free Disks, Inc. 69
Roger's Systems Specialist 72
Shreve Systems 44
Techniks, Inc. 70
Ultralink 70
Upstate Games 69

Software

Electro Science Applications, Inc. 86
Gibraltar Trade Center, Inc. 60
Globaltech Distributors 70
Pioneer Hill Software 54

Microcontrollers / I/O Boards

EMAC, Inc. 91
Intuitive Circuits LLC 16
Jameco Electronics 45
Junkware.com 70
La Paz Electronics Int'l. 59
Micromint 17
Ontrak Control Systems 68
OS Systems 88
Parallax, Inc. ....Back Cover
PARAMAX, INC. 85
Prairie Digital, Inc. 69
R.E. Smith 70
Scott Edwards Electronics, Inc. 28
Square 1 Electronics 13
Technological Arts 62
Ultralink 70
Vesta Technology, Inc. 70

Printers/Printer Supplies

H.T. Orr Computer Supplies....59
Inkjet Southwest 36

DESIGN/ENGINEERING SERVICES

Chicago Circuits Corporation....53
DesignNotes.com....30
Electro Science Applications, Inc. 86
ExpressPCB....47
Midland Technologies 70
Prairie Digital, Inc. 69
Pulsar, Inc. 73
V&V Mach. & Equipment, Inc. 68-70

EDUCATION

Electro Science Applications, Inc. 86
EMAC, Inc. 91

EVENTS/SHOWS

ACP Super Store 46
Gibraltar Trade Center, Inc. 60
Tropical Hamboree 85

KITS

Alltronics 31
C & S Sales, Inc. 70
Digital Products Company 70
Earth Computer Technologies. 58
Electronic Products 70
EMAC, Inc. 91
Gateway Electronics, Inc. 38
Information Unlimited 34
Inkjet Southwest 36
Jade Products, Inc. 68
Quality Kits....70
Ramsey Electronics, Inc. 37
Scott Edwards Electronics, Inc. 28
SiGEM 70
Technology Electronics, Ltd. 68
USI Corp. 14
Velleman 41
Weeder Technologies 87

LASERS

Information Unlimited 34
Meredith Instruments 35
Resources Un-Ltd. 42
Unicorn Electronics 28

MISC./SURPLUS

All Electronics Corporation 56
Alltech Electronics 53
C and H Sales Company 55
Communication Surplus 68
Consumertronics....40
DeMar Electronics 69
EPS 69
Equipment Management Technology 52
Excess Solutions 54
Fair Radio Sales 27
Halted Specialties Co. 3
Hyatt Electronics 89
Jam RF 52
Levy Latham 47
Linear Systems 11
PCB Express, Inc. 69
Power Quality, Inc. 68
Resources Un-Ltd. 42
Shreve Systems 44
Skycraft Parts & Surplus, Inc. 59
Surplus Traders 68
Timeline, Inc. 61
Unicorn Electronics 28
Visitect, Inc. 60
Weeder Technologies 87

PROGRAMMERS

Advanced Transdata Corporation 21, 35
Andromeda Research....22
Electronic Products 70
General Device Instruments 68
Intronics, Inc. 59
M2L Electronics....62
microEngineering Labs 11
Upstate Games 69

PUBLICATIONS

AK Peters 61
Antique Radio Classified 69
Consumertronics....40
intelligence 69
Netcom 25
Square 1 Electronics 13

RF TRANSMITTERS/ RECEIVERS

Abacom Technologies 63

ROBOTICS

AK Peters 61
Astro Too 69
Lemos International Co., Inc. 67
Lynxmotion, Inc. 22
OS Systems 88
PARAMAX, INC. 85
SuperCircuits 82

SATELLITE

Baylin Publications....73
Milestone Products 23
SiGEM 70

SECURITY

Bitz Technology 68
Fusion Electronic Security 35
Information Unlimited 34
intelligence 69
J. J. Hill 68
Lemos International Co., Inc. 67
Matco, Inc. 69-70
MSC Electronics 69
Norcomm 24
Polaris Industries 15
SuperCircuits 82
Visitect, Inc. 60

SOLAR EQUIPMENT

STEPPER MOTORS

Alltronics 31
Ontrak Control Systems 68
PARAMAX, INC. 85

TELEPHONE

Digital Products Company 70
Globaltech Distributors 70
Telulex, Inc. 81
Weeder Technologies 87

TEST EQUIPMENT

ABC Electronics 40
Alfa Electronics....40
Allison Technology Corp. 63
AST Global Electronics....84
Astro Too 69
C & S Sales, Inc. 70
C and H Sales Company 55
Circuit Specialists, Inc. 94
DesignNotes.com....30
Digital Products Company 70
DMD Systems Recovery, Inc. 69
EDS 55
Electro Tool, Inc. 59
Equipment Management Technology 52
Howard Electronics....20
Intronics, Inc. 59
J-Works, Inc. 88
Levy Latham 47
MCM Electronics 19
Metric Equipment Sales, Inc. 67
Optoelectronics....4
Phelps Instruments 86
Pioneer Hill Software 54
Power Quality, Inc. 68
Prairie Digital, Inc. 69
PTL Test Equipment, Inc. 39
R & S Surplus....83
Saelig Company 24
Seabird Technical 69
Telulex, Inc. 81
Test Equipment Plus....59
Tucker Electronics....29
Western Test Systems....32-33

TOOLS

Advanced Transdata Corporation ...21, 35
C & S Sales, Inc. 70
Electro Tool, Inc. 59
Graymark....92
Howard Electronics....20
Hyatt Electronics 89
The RF Connection 11

WIRE/CABLE & CONNECTORS

Roger's Systems Specialist 72
The RF Connection....11

Questions & Answers

TECH FORUM

This is a READER TO READER Column. All questions AND answers will be provided by *Nuts & Volts readers* and are intended to promote the exchange of ideas and provide assistance for solving problems of a technical nature. All questions submitted are subject to editing and will be published on a space available basis if deemed suitable to the publisher. All answers are submitted by readers and *NO GUARANTEES WHATSOEVER* are made by the publisher. The implementation of any answer printed in this column may require varying degrees of technical experience and should only be attempted by qualified individuals. Always use common sense and good judgement!

QUESTIONS

Send all material to **Nuts & Volts Magazine**, 430 Princeland Court, Corona, CA 92879, OR fax to (909) 371-3052, OR E-Mail to **forum@nutsvolts.com**

I enjoy listening to AM broadcast band DX on my portable AM/FM radio. Is there a simple way I can add an analog S-meter to it for AM reception only?

12991 **Marvin Rosen**
Baltimore, MD

I need to locate a source for Signetics 95H90 and 9582 prescaler ICs for my frequency counter, or a suitable substitute.

12992 **Philip D. Greenway**
Fayetteville, GA

I really enjoyed Evert Fruitman's article "Automatic Night LED" in the Oct. '99 issue of *Nuts & Volts*.

All my flashlights seem to grow feet and walk off and hide just when I need them.

What I would like to find is a circuit that has both a flashing LED, and piezoelectric beeper. Both activated approximately once every 30 seconds.

The LED for finding the flashlight at night, and the beeper for daylight hiding flashlights.

Perhaps two models: **1**. High power, but low parts count, and therefore cheap. **2**. One with the absolute lowest power drain. This one would require more parts (??) and therefore cost more.

12993 **Stuart B. Wahlberg**
Blythe, CA

I have an RCA VCR model No. VKP925T. When I try to play a cassette, the entire screen is filled with neat columns and rows of the same cipher. Any help with this problem would be appreciated.

12994 **Mark Weinstein**
Wantagh, NY

I have recently come into possession of a Webster-Chicago wire recorder transport mechanism, model 79-1, SN 730. Unfortunately, there was no electronics attached to it.

Where can I find either the electronics package or complete plans to build it? I would also need the wire which the recorder uses.

12995 **Mark Weinstein,**
Wantagh, NY

I would like to figure out how to make my door locks keyless. They are already electric, so some sort of transmitter is all that would be necessary, but I'm not sure how to do this.

12996 **Nathan Wilson**
Ogden, UT

I am investigating using a PC to operate different peripherials. The main difficulty that prevents Turbo C from being used to implement many programs is its dependence on the system clock, 18.2 ticks per second, much too slow for many applications.

However, looking at a book describing Microsoft C v6.0, I was surprised to learn that it was able to measure events much quicker, 450,000 ticks per second. At this rate, a C program could be used for many real-time applications.

Does the speed of response for a C program depend on the particular compiler being Visual C, Ansi C, etc.?

12997 **Thomas Ng**
San Jose, CA

I have a student who needs help with a VICA project. He wants to build a Tesla coil that operates from 12V (two six-volt lantern batteries).

We know we can use a 555-timer circuit to generate the pulses we need, but also need an efficient way to boost the voltage out of the pulser circuit to 25V-50KV.

I have some flyback transformers, but am not sure if that would be the proper way to get the job done.

12998 **David Mixer**
Leander, TX

Can someone suggest a source of information on fusible resistors?

What are they? How are they constructed and tested? How are they specified?

12999 **Wendell Couts**
Nashville, TN

I read the article on "Reviving NiCad Powered Devices" and have a question.

Thirty years ago, I used to build power supplies for reclaiming gold by electroplating and the major problem was "dendrites" growing between the plates and having them short out. We then switched to "periodic reverse" plating in which for gold it was about 90% plating followed by 10% deplating. This seemed to have a smoothing effect and there were no complaints about shorts, then they switched over to them completely.

It would be interesting to know if a NiCad charger could be built using this technique to eliminate this problem and, of course, incorporate the other features that he mentioned about charging current.

129910 **Charles Andrew**
via Internet

I need information on how to use the Intel "Prompt 48" microcomputer design aid. Schematics would be helpful, but the user manual will suffice.

129911 **Bill Kotaska**
St. Louis, MO

I read enthusiastically *Nuts & Volts* articles on NC routers because I was building one. It is complete now, but has a serious motor noise problem.

I am using a 14,000 RPM 120V .5A AC-DC motor and it throws horrible garbage on the logic board even though everything is disconnected except the power cords. I even isolated them with an unplugged, uninterruptable power supply, so it must be radiated. It looks like about 60 MHz on a scope, but is all over the nearby FM radio band.

How can I quiet it down so the logic board will stop getting lost?

129912 **Jim Soquel**
via Internet

I was posed the following question regarding stranded versus solid wire.

Supposedly, stranded wire of a particular gauge is rated to carry more current than a solid wire of similar gauge (at DC or power line frequencies where skin effect is negligible). I was unable to explain why, as this definitely is not within my area of expertise.

First, making it clear that I didn't know what I was talking about, I did speculate that the stranded wire would have more surface area, thus more heat dissipation ability, but it seems that would be a factor only in the case of uninsulated wire. This brings up three questions:

1. Is it true that stranded wire has higher current carrying capability?

2. If the answer to question #1 is yes, why is this?

3. Does stranded wire of a particular gauge have more, less, or the same metallic crossectional area as its solid wire counterpart of a similar gauge?

129913 **David J. Mehrl**
Lubbock, TX

ANSWER INFO

- Include the question number that appears directly below the question you are responding to.
- Payment of $25.00 will be sent if your answer is printed. Be sure to include your mailing address if responding by E-Mail.
- In most cases, only one answer per question will be printed.
- Your name, city, state, and E-Mail address, (if submitted by E-Mail), will be printed in the magazine, unless you notify us otherwise with your submission.
- The question number and a short summary of the original question will be printed above the answer.
- Unanswered questions from a past issue may still be responded to.
- Comments regarding answers printed in this column may be printed in the Reader Feedback section if space allows.

QUESTION INFO

TO BE CONSIDERED FOR PUBLICATION

All questions should relate to one or more of the following:

1) Circuit Design 3) Problem Solving
2) Electronic Theory 4) Other Similar Topics

INFORMATION/RESTRICTIONS

- No questions will be accepted that offer equipment for sale or equipment wanted to buy.
- Selected questions will be printed one time on a space available basis.
- Questions may be subject to editing.

HELPFUL HINTS

- Be brief but include all pertinent information. If no one knows what you're asking, you won't get any response (and we probably won't print it either).
- Write legibly (or type). If we can't read it, we'll throw it away.
- Include your Name, Address and Phone Number. Only your name will be published with the question, but we may need to contact you.

TECH FORUM

I have an EEPROM reader and writer card that plugs into an eight-bit ISA slot on the motherboard of my desktop.

Often I have to reprogram an EEPROM at a job site, but this requires me to go back to the shop to rewrite the EEPROM, then back to the job.

Does anyone know a way to hook this ISA card to a laptop so that I can program the EEPROM in the field? It's an old laptop, so I do not mind making any necessary modifications to it. I'll also have access to 110V, if necessary.

129914 **Dean Thompson**
Phoenix Electronics
DBT4251@aol.com

I have an older, color Mac scanner. Is it possible to convert it to PC?

129915 **Jordan P. Barrette**
via Internet

ANSWERS

ANSWER TO #109914 - OCT. 1999

I am seeking information on how to build a battery load tester.

The testing of lead acid or any other type battery consists of more than simply measuring the terminal voltage. All batteries experience failure in several ways.

Lead acid typically will fail from either high impedance, basically the internal cells will become insulators. This is evident when applying charging voltage to the cell(s) and the terminal voltage = the charging voltage, and very low or no current flow from the charging circuit into the cell(s). Sometimes applying a much higher charging voltage will cause the cell(s) to accept current, and they may rejuvenate.

Doing this, you must monitor the voltage and current closely, and provide a constant current source that will limit the maximum current. This can be as simple as a light bulb in series with one of the terminals. Also, monitor the battery or individual cells for excessive heating. Even a small current across a high impedance cell can cause excessive heating if the charging voltage is well above the rated voltage of the battery or cell.

A high impedance cell with a high voltage drop across it and minimal current flow can produce excessive heat. (P=E x I)

The second typical failure is the LOW charge capacity. (I charge it all week, and it goes dead in 15 seconds.) Again, measuring the open circuit terminal voltage, it will show full rated voltage. But apply a typical load of say 1/10 the amphour rating and measure the time for the cell voltage to reach about 1.75V/cell or about 10 volts for a 12-volt battery. The time should be somewhere near 10 hours. (x amphours discharged at 1/10 x rate = 10 hours.) Anything less than this indicates a battery that is low in capacity compared to rated capacity.

The only drawback is you need to

ANSWERS TO #109915 - OCT. 1999

I recently bought a Leviton DHC X-10 Inductive Dimmer Switch. I tried it on my ceiling fan and it worked, but caused an annoying hum. I want to replace the triac inside of it with a Teccor "Alternistor." Would this improve the hum? Is it safe to attempt this kind of modification?

#1 The hum in the fan is caused by the core of the motor vibrating due to the time varying magnetic fields. It could be that the core laminations are somewhat loose, or it could be that the motor is not well-isolated mechanically from the housing.

Vibration is also probably being transmitted to the ceiling, which makes an excellent sound board. Due to the inductive nature of a motor and transformer (or relay for that matter), usually a controller designed for fan use should be used.

As with any SCR or TRIAC controller, there are different control methods. The simplest is to turn on the load at some non-zero point in the AC sinewave. This effectively changes the average voltage (since the current is actually only on for a portion of the sinewave). Earlier fan controllers used tapped inductors to control the current. This provided a uniform, but reduced amplitude sinewave for the motor.

SCR controllers are used extensively in high power variable DC power supplies. Since the chopped AC is rectified and followed with a matched filter network, the fractional sinewave input is not a problem.

As for the alternistor, substituting it for a pair of SCRs or TRIAC would have no effect on the hum. These devices all operate basically the same way, though the statement that the alternistor is better for highly inductive loads suggest it will not self-destruct as easily from the transients produced when switching an inductive load.

AC or DC, interrupting the current flow through an inductor (as when opening a switch, or turning off an SCR) can still produce transients capable of destroying semiconductors.

As to whether you would want to undertake a component exchange, as long as you know that the devices are interchangeable (voltage and current ratings similar and the available drive signal is adequate). And you are comfortable making such modifications, go ahead. But since it won't affect the objectionable hum, why bother. As a side note, some fans simply produce more audible noise than others.

Rick Nelson
Newport News, VA

#2 The problem with the triac dimmer control on an inductive load is the delay in turning on the device for a portion of the AC power cycle to effect the dimming or speed control.

This delay in turning the device on causes a square edge on the leading edge of each cycle. The inductive motor does not like this rapidly rising edge. It causes the accompanying hum in the motor. All triacs typically turn off when the trailing edge of the AC sine- wave nears zero volts (typically 1-2 volts depending on the holding current of the particular device).

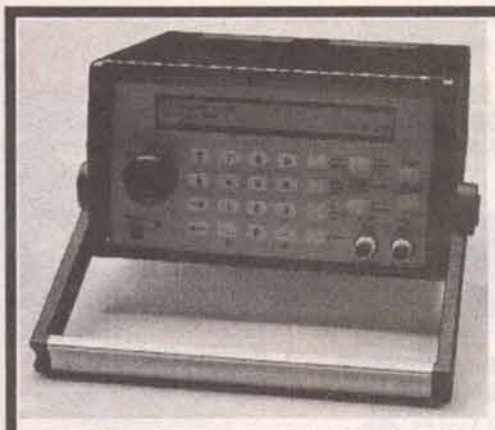
This trailing edge shut-off of the device typically will not cause the hum in the motor. It is caused by the rapidly rising edge on the front of the cycle when the triac is abruptly turned on when the adjusted threshold voltage is reached.

These type devices all work the same with the rapidly rising turn on voltage, and turn off being near the zero crossing when the load current drops below the holding current.

The device you mention, if it's only improvement, is its better turn off characteristics. I would think it would make little difference in the hum from the fan. The only thing that should effect that is to slow the turn on rising edge. But in so doing, you will create additional heat in the device because the turn on not being instantaneous will have load current flowing across the device while it is slowly turning on.

I am wondering if a non-polarized capacitor across the motor, and maybe an inductor in series might smooth the abruptly rising edge, and dampen the hum. Guess you would call that a filter ...

Ed Pruitt
Keller, TX



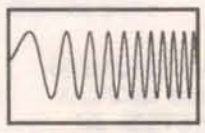
Telulex Inc. model SG-100A

New Features:
✔ 21.5 MHz
✔ .01 Hz steps
✔ multi-unit phaselock

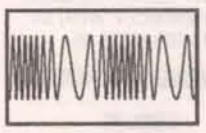
Telulex Inc.

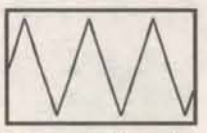
Any waveform you want!

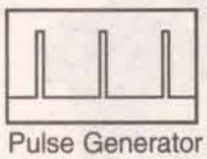
- **Synthesized Signal Generator**
  Clean sinewaves DC-21.5 MHz with .001% accuracy! .01 Hz steps. DC Offset. RS232 remote control.
- **Arbitrary Waveform Generator**
  40 Megasamples/Second. 32,768 points. 12 bit DAC
- **Function Generator**
  Ramps, Triangles, Exponentials, Noise & more. 0 to 2 MHz in 1 Hz steps. Continuous or Triggered.
- **Pulse Generator**
  Digital waveforms with adjustable duty cycle


DC to 21.5 MHz linear and log sweeps

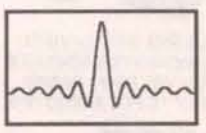
Int/Ext AM, SSB, Dualtone Gen.

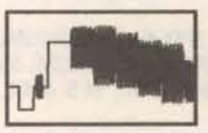

Int/Ext FM, PM, BPSK, Burst


Ramps, Triangles, Exponentials


Pulse Generator

Noise


Arbitrary Waveforms


Unlimited Possibilities!

2455 Old Middlefield Way S
Mountain View, CA 94043

Tel (650) 938-0240
Fax (650) 938-0241

http://www.Telulex.com
Email: sales@Telulex.com

Write in 59 on Reader Service Card.

monitor the battery for 10 hours. Obviously, discharge rates approaching the one-hour rate (i.e., 7 amp load for a 7 amphour) the battery should hold for one hour.

Many batteries like the ones you mention are generally designed for lower discharge rates typically 1/10 of the amp rating for one-hour rate. This has to do with the internal connections to and between cells.

Higher currents cause excessive internal voltage drop, and cause heating. In most cases, a quick test will fail to disclose a low capacity battery.

The third failure mode is shorted cells. This will cause the open terminal voltage to be lower than the rated voltage, by two volts per cell. So, if a 12-volt battery has one shorted cell, its terminal voltage will indicate 10 volts.

The confusing part of this is the charge state of the battery. It could be virtually fully discharged, and all cells okay, and read 10 volts. This test should be performed with a typical charging circuit applied to the battery.

If the example 12-volt battery reads 10 volts while being charged, it likely has shorted cells. Shorted cells cause the charge current to increase unless some type of constant current charger is being used.

So a simple push-button tester with LEDs to indicate good, bad etc., is going to be something like the auto stores are using. It is a microprocessor controlled testing sequence to test for all failure modes. They are built for specific battery groups like the typical automotive 12-volt battery.

A fairly simple circuit would have a voltmeter, a load to discharge the battery over time, and a charging circuit to make sure the battery is as fully charged as it can be prior to testing the terminal voltage, then the discharge time using the load, all the time monitoring the voltage, and current into and out of the battery.

Usually when I have a battery of questionable quality, I charge it for 10-14 hours at 1/0 at its amphour rating, and then discharge it into a typical load, and see how long before it fails. I do this after I have determined it is not high impedance or has shorted cells.

Ed Pruitt
Keller, TX

ANSWER TO #11996 - NOV. 1999

Does anyone know of a product that can block Caller ID in Australia?

There is no way for a customer to stop Caller ID signals from going out, they are generated by the phone company at the switching center.

The telcos in the USA are required to not send the data if the customer requests, either on a per-call basis or on all calls. The only exception is when calling toll-free numbers and emergency services. The Australian phone company probably does the same, check with them.

Mark Phillips
Kings Park, NY

ANSWER TO #11991 - NOV. 1999

Does anyone know of a good reference book or information on troubleshooting strobe lights that work off of the 12-volt system in a vehicle?

Try this website for strobe-related questions: **http://repairfaq.physik.tu-berlin.de/repairfaq/strbfaq.htm**.

Twelve-volt strobe systems, much like 12-volt capacitive discharge ignition systems use a DC-to-DC converter to increase the 12 volts to somewhere around 300 volts.

This voltage is stored across a capacitor designed with minimal internal inductance. A much smaller capacitor, perhaps 0.1uF, is also connected to this voltage through a resistor to limit its charge rate.

A diac is then generally used, in series with a trigger transformer with the smaller capacitor as its power source, to ionize the gas in the flash tube. A fine wire wrapped around the flash tube or a conductive paint stripe on it is usually used for this.

Once the gas is ionized, it becomes conductive and the energy in the larger capacitor is given up in the ensuing flash. The flash rate is determined by the rate at which the smaller capacitor charges to the diac breakdown voltage, which is usually about 22 volts.

In the case of a triggered strobe — as would be used in photography — the diac is replaced with a switch. A diac is basically just a SCR that conducts when a given voltage is reached. Some circuits use a neon bulb in its place.

Klaus
via Internet

ANSWER TO #11998 - NOV. 1999

I want to experiment with varying light intensities using ordinary household light bulbs.

I need to automatically and very slowly, cycle voltage up and down between 60 VAC (or so), and 120 VAC, taking as much as 20 minutes to go all the way up and as much as 30 minutes to go all the way down.

Your ideal lamp controller can

AMAZING MICROVIDEO!

SUPERCIRCUITS.COM
America's #1 Microvideo Source

Buy your microvideo equipment where NASA, The Air Force, JPL, Lawrence Livermore Labs and the FBI does. Call us today.

For the best in high performance microvideo equipment, call the experts at Supercircuits. We've grown to be America's microvideo leader by consistently offering the best equipment at the lowest prices, with unbeatable service...compare our plug 'n play ease of use, warranties and return policies. Of course, Supercircuits microvideo is used by some of the biggest names in science, industry and national defense. But with prices starting at under $35 for tiny high resolution video cameras, it is truly technology that is as affordable as it is amazing. Call us today at 1-800-335-9777 for a free microvideo catalog, loaded with photos, specs and more. Or log onto our website at www.supercircuits.com. You'll be amazed!

LIPSTICK VIDEO CAMERAS
MICRO COLOR CAMERA 1" X 1" 350 TVL $89.95!!
STEALTHY SUPER PINHOLE $69.95
COLOR $149.95
1 YEAR WARRANTY
FREE CATALOG! CALL US TODAY AND GET YOURS!
WOW!
FREE PLUG & PLAY CABLES
1 YEAR WARRANTY
STEALTHY SEE-IN-THE-DARK WEATHERPROOF WITH 56 IR LED's $159.95
$34.95
1 YEAR WARRANTY
.04 LUX
460 TVL
2 YEAR WARRANTY
CCTV VIDEO CAMERA $79.95!
SONY CHIPSET
WORLD'S SMALLEST! LISTED IN 1999 GUINNESS BOOK OF RECORDS
AMAZING!
MICRO VIDEO CAMERA $59.95!
1 YEAR WARRANTY
WIRELESS VIDEO
WORLD'S SMALLEST VIDEO CAMERA & TRANSMITTER- 700 FOOT RANGE $299.95
1 YEAR WARRANTY
DIGITAL VIDEO RECORDER
480 HOURS RECORDING TIME, IBM COMPATIBLE, 4 CAMERA SWITCHER
WIRELESS VIDEO
$99.95
2.4 GHz AUDIO/VIDEO TRANSMITTER, RECEIVER W/ 700 FOOT RANGE PART 15 FCC APPROVED
HEAD MOUNTED VIDEO DISPLAY SYSTEM- 3D CAPABLE $599.95
AMAZING NEW UNDERCOVER VIDEO
CAP CAM $149.95
GLASSES CAM
TIE CAM
BAG CAM
PAGER CAM
SONY GV-A500HI-8 VCR WITH 4" TFT MONITOR $979.95
UNBEATABLE DEAL!
350 Lines of Resolution
COLOR VIDEO CAMERA- AUDIO, PLUG & PLAY- ONLY $69.95!!
STEALTHY PINHOLE VIDEO CAMERA $34.95 410 TVL, 0.5 LUX, 1.2"
COVERT CLOCK RADIO CAM $249.95
1-800-335-9777 ext NV
Or fax us at 512-260-0444
www.supercircuits.com
Free Catalog- Call Us Today And Get Yours 1-800-335-9777
www.supercircuits.com

Write in 60 on Reader Service Card.

TECH FORUM

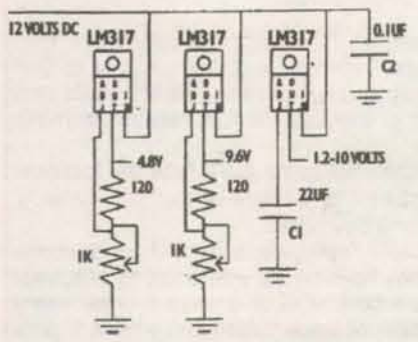
be found at **Jameco, 1-800-831-4242**. They offer an electronic kit; part number 127589 is a slow on, slow off dimmer that has two modes of operation. Dims are two seconds to one hour, and a timer dimmer independent adjustment one second to 30 minutes. See page 79 of their new catalog #993.

Joseph Kish
Clackamas,OR

ANSWER TO #11992 - NOV. 1999

I have a robotics project that has a 12-volt system. I need to reduce the voltage to 4.8 and 9.6 volts to run servos and accessories. Also, I need to reduce the main drive motor voltage to three volts, then increase to 12 volts over five seconds.

You left out an important piece of information: The current required by your circuits. If the current draw is less than 1.5 amps, these circuits will do:



The rate of voltage rise is determined by the value of C1. Smaller is faster. You will lose about two volts in the LM317, so the maximum output is 10 volts with 12 volts input.

Russell Kincaid
Milford, NH

ANSWER TO #9996 - SEPT. 1999

I have a NEC model #DX-1000U VCR that has encountered a microprocessor failure. Can you direct me to someone who can supply me with old NEC parts?

You're going to have to hit the hamfests, swap meets, garage sales, rummage sales, Goodwill, Salvation Army, and probably several local radio/TV/VCR shops to find that VCR, or one that has that CPU in it.

If you're really desperate, and you have Internet access, you can go to sites like E-bay and such, and post that you are looking for a NEC DX-1000U.

Please note: A lot of these places will want to sell you the whole VCR. But, if it is working, and in better shape. I would just keep the other VCR as spare parts.

Terry Baker
Lindstrom, MN

ANSWER TO #11993 - NOV. 1999

I need hook-up schematics of E-Lab's serial-to-parallel interface (EDE 1400) and parallel/serial transceiver (EDE 300).

A prime choice may be to check the manufacturer's website or to contact them directly. They will probably be able to give you the data (for free), they are:

E-Lab Digital Engineering, Inc., 1932 Hwy 20, P.O. Box 246, Lawton, IA 51030-0246. E-Mail: **elab@netins.net** Web: **www.netins.net/showcase/elab** Voice: **712-944-5344** fax **712-944-5501**.

Thomas Ng
San Jose, CA

ANSWERS TO #11994 - NOV. 1999

I need a source and supplier for electronic radio tubes.
I repair and restore old radios and the tubes are difficult to find.

#1 Although solid-state devices currently dominate today's electronics, vacuum tubes are still being used to build guitar amplifiers and by audiophiles in their high-quality audio component systems. Tubes are also still being used in audio recording studios, in specialized types of audio processing equipment.

As the demand for tubes being used in these applications continues, it has forced prices upward. For an excellent article about this, go to **www.spectrum.ieee.org/select/0898/tube.html#sb2**

One of the best sources for tubes and other old radio parts is **Antique Electronic Supply** in Tempe, AZ. They have a nice catalog which lists over 70 pages of tubes, sockets, speakers, grill cloth, books, knobs, and other hard-to-find parts; **1-800-706-6789**. They also list many old (tested) tubes, as well as "new, old stock" (NOS) tubes. Their catalog is also a helpful source of information about the parts, which ones might most appropriately be used, etc. They can furnish copies of old radio schematic diagrams for $6.50 each. Their web site is located at **www.tubesandmore.com**

Another good source for tubes is **RF Parts Company**, **1-800-737-2787** or **1-800-RFPARTS**. Their web site is located at **www.rfparts.com** They have a minimum order of $25.00, but their prices are good. Their online catalog lists a large assortment of receiving tubes, as well as tube sockets and other parts.

The major manufacturers of tubes are now in Russia (Svetlana and Sovtek), China, Yugoslavia, the Czech Republic, and in Eastern Europe. During the recent war in Kosovo, one of the Yugoslovia tube factories was damaged by the bombing, so it may be some time before they resume tube production. A web search for Svetlana will take you to a page with a multitude of related links. **www.svetlana.com/docs/relatedsites.html**

The quality of tubes made in China has been questioned by many, and you should be aware that many private label tubes currently being sold are made in China.

Continued on next page

SURPLUS TEST EQUIPMENT

HEWLETT PACKARD

11664A, RF Detector, .01-18GHz $250
11666A, Reference Bridge, 0.4-18GHz $800
11721A, Frequency Doubler $600
11975A, Amplifier, 2-8GHz $2000
1650B, 80 Channel Logic Analyzer $2000
16500A, Logic Analyzer Mainframe $750
214B, 10MHz Pulse Generator $1000
3312A, Function Generator, .1Hz-13MHz $700
3325A, Synthesizer/Function Generator $1000
3325A/01/02, Synthesizer/Function Generator $1500
3335A, Frequency Synthesizer, 200Hz-81MHz w/Opt. 01 ..... $4000
3456A, Digital Multimeter, 6.5 Digits $800
3468A, 5.5 Digit Multimeter $300
3468B, 3.5 to 5.5 Digit Multimeter $375
3478A, Digital Multimeter $700
3488A, Switch Control $400
3551A, Transmission Test Set $600
3562A, Dynamic Signal Analyzer $5000
35677A, S-Parameter Test Set $1500
3575A, Phase Gain Meter 1Hz-13MHz $1000
3577A, Network Analyzer, 5Hz-200MHz $6000
3581C, Selective Voltmeter $800
3582A, Spectrum Analyzer, 0.02Hz-25.5KHz $1600
3585A, Spectrum Analyzer, 20Hz-40.1MHz $4750
3852A, Data Acquisition/Control Unit $1000
4342A, Q-Meter $1800
435B, Power Meter $300
436A, Power Meter w/Opt. 022 ..... $700
438A, Power Meter $2750
4935A, Transmission Impairment Test Set w/Opt. 003 ..... $1100
5316B, Universal Counter $800
5328B, Universal Counter $1000
5340A, Frequency Counter w/Opt. 01/02/011 ..... $1000
5342A, Microwave Frequency Counter, 10Hz-18GHz $900
54100A, Digitizing Oscilloscope $1700
54100D, 1GHz Digital Oscilloscope $2700
54110D, 1GHz Color Digitizing Oscilloscope $2500
54201D, Digitizing Oscilloscope $2650
6011A, Autoranging Power Supply, 20V/120A, 1000 Watt $1200
6012B, DC Power Supply, 0-60V/0-50A/1000 Watt $2250
6034A, DC Power Supply, 0-60V/0-10A, 200 Watt $1000
6274B, DC Power Supply, 0-60V, 0-15A $1250
6475C, DC Power Supply, 0-110V, 0-100A $3500
6632A, DC Power Supply, 0-20V, 0-5A, 100 Watt $1000
7035B, X-Y Recorder $250
778D, Dual Directional Coupler $400
8013B, Pulse Generator $500
8082A, Dual Pulse Generator, 250MHz $1200
8112A, 50MHz Pulse Generator $3300
8116A, 50MHz Programmable Pulse/Function Generator $3000
8165A/002, Programmable Signal Source w/AM $1500
8341A, Synthesized Sweeper, 0.01-20GHz w/Opt. 02 ..... $13,000
8341B, Synthesized Sweeper, 0.01-20GHz $14,500
8347A, RF Amplifier, 100KHz-3GHz $2500
8349B, Microwave Amplifier, 2-20GHz $4000
8350A, Sweep Oscillator Mainframe $1000
8350B, Sweep Oscillator Mainframe $1250
83522A, Sweeper Plug-in, .01-2.4GHz, w/Opt. 02 ..... $3500
83525A, RF Plug-in, .01-8.4GHz. w/Opt. 02 & 04 ..... $5000
83545A, Oscillator Plug-in, 5.9-12.4GHz $1750
8495H, Programmable Attenuator (unused) $600
8501A, Storage Normalizer $1000
85021B, Directional Bridge $1200
8510B, Network Analyzer w/Opt. 010 ..... $13,000
8511A, Harmonic Frequency Converter, 45MHz-26.5GHz $5500
8554B, RF Spectrum Analyzer Plug-in, 500KHz-1250MHz $800
8569A, Spectrum Analyzer, .01-22GHz $4500
86222B, Sweep Oscillator Plug-in, .01-2.4GHz w/Opt. 04, Rear Output and 8620C Mainframe $1250
86290A, RF Plug-In, 2.0-18GHz $1150
86290C, RF Plug-In, 2.0-18.6GHz $1550
8640A, Signal Generator, 0.5-512MHz $700
8640B, Signal Generator, Opt. 002, .5-1024MHz $2100
8640B, Signal Generator, Opt. 1, 2 ..... $2200
8654A, Signal Generator, 10-520MHz $450
8656A, Signal Generator, 100KHz-990MHz $1700
8656B, Signal Generator, 0.1-990MHz w/Opt. 02 ..... $2250
8660C, Synth. Signal Generator w/Opt. 1 & 100 ..... $1000
86603A, RF Plug-In, 1-2600MHz $800
86603A, RF Plug-In, 1-2600MHz w/Opt. 02 ..... $950
8662A, Synthesized Signal Generator, 10KHz-1280MHz $13,000
8663A, Synthesized Signal Generator, 100KHz-2560MHz $27,500
8671B, Synthesized CW Generator $5500
8672A, Synth. Signal Gen., 2.0-18.0GHz $3500
8672A, Synth. Signal Gen., 2GHz-18GHz, w/Opt. 08 ..... $4500
8748A, S-Parameter Test Set w/Opt. 026 ..... $1350
8756A, Scalar Network Analyzer $1500
8757A, Scalar Network Analyzer, 10MHz-60GHz $4000
8970A, Noise Figure Meter $4500

TEKTRONIX

11A32, Two Channel Amplifier Plug-In, DC-400MHz $1250
11A34, Four Channel Amplifier Plug-In, DC-300MHz $1500
11A52, 600MHz Two Channel Vertical Amplifier $700
1503, TDR Cable Tester w/Opt. 04 Recorder $1550
1503B, TDR Cable Tester w/Opt. 04 ..... $2450
2215, 60MHz Oscilloscope $500
2236, 100MHz Oscilloscope w/Counter/Timer/DMM $700
2246, 100MHz Oscilloscope $1600
2247A, 100MHz Oscilloscope w/Counter/Timer/Voltmeter $2500
2337, 100MHz Oscilloscope w/DMM $1650
2430A, 150MHz Digital Oscilloscope $2350
2430R, 150MHz Digital Storage Oscilloscope $1850
2432A, 300MHz Digital Storage Oscilloscope $3000
2445, Four Channel 150MHz Oscilloscope $1500
2465, Four Channel 300MHz Oscilloscope $2000
2465A DV, Four Channel 350MHz Oscilloscope $3850
2465CTS, Four Channel 300MHz Oscilloscope w/CCT/WR $2500
2467, Four Channel 350MHz Oscilloscope $3000
2467B, Four Channel 400MHz Oscilloscope $4500

VISIT OUR WEBPAGE AT WWW.RSSURPLUS.COM

2630, Fourier Analyzer $2500
466, 100MHz Storage Oscilloscope w/DM44 ..... $800
475, 200MHz Oscilloscope $650
475A, 250MHz Oscilloscope $800
492P, Programmable Spectrum Analyzer, 50KHz-21GHz w/Opt. 1/2/3 ..... $7000
577/D2, Curve Tracer, Non-storage w/177 Fixture $1750
7D20, Programmable Digitizer $400
7L5/L3, Spectrum Analyzer, 20Hz-5MHz, w/Opt. 025 Tracking Generator $1850
7L12, Spectrum Analyzer, 100KHz-1.8GHz $1500
7L18, Spectrum Analyzer Plug-in, 1.5-18GHz Capable of 60GHz with Mixers $2500
7S12, TDR/Sampler $450
TM5003, Three Slot Power Mainframe $450
TM5006, Six Slot Power Mainframe $550

MISCELLANEOUS

Acme Elect. PS2L1000, Electronic Load $650
Datron 1061A, 6.5 Digit Autocal Multimeter, DC Only $700
Datron 1062, 6.5 Digit Autocal Multimeter, DC/AC/Ohms $900
EIP 545A, Microwave Frequency Counter $800
EIP 548A, Frequency Counter, 10Hz-26.5GHz $2000
EIP 548B, Frequency Counter, 10Hz-26.5GHz $3250
EIP 578, Source Locking Frequency Counter $2500
Fluke 5100B, Voltage Calibrator W/Opt. 03 & 05 ..... $2500
Fluke 5200A, AC Voltage Calibrator w/5205A Amp $1850
Fluke 7261A, Universal Counter/Timer, 0Hz-125MHz $350
Fluke 8010A, Digital Multimeter $175
Fluke 8012A, Digital Multimeter $175
Fluke 8050A, Digital Multimeter $250
Fluke 8502A, Digital Multimeter, DC Only $225
Fluke 8520A, Digital Multimeter $350
Fluke 8600A, Digital Multimeter $65
Fluke 8810A, Digital Multimeter $250
Fluke 8840A, Digital Voltmeter w/Opt. 059 ..... $600
Keithley 195A, Digital Multimeter $700
LeCroy 7200, Precision 400MHz Digital Oscilloscope w/ (2) 7242B Plug-Ins $7000
LeCroy 9450, 350MHz High Performance Digital Oscilloscope $3250
Marconi 2019A, Signal Gen., 80KHz-1040MHz $2200
Polarad 1105E-FT, Signal Generator, 0.8-2.4GHz $400
PTS 500, Frequency Synthesizer, 1-500MHz $450
Systron Donner 6530, Frequency Counter 10Hz-26.5GHz $1000
Trans. Devices DLR400-15-2500A, Dynamic Load $1500
Trans. Devices DLVP 130-110-1000 Electronic Load $950
Valhalla 2703, AC Voltage Standard $2350
Wavetek 171, 2MHz Synth. Function Generator $450
Wavetek 178, Automatic Synthesizer $1700
Wavetek 852, Dual Hi/Lo Filter $1000
Wavetek 2001A, Sweep Generator, 1-1400MHz $450
Wavetek 2500A, Signal Generator, .2-11MHz $2250
Wavetek 3000-200, Signal Generator $900
Wavetek 8003, Precision Scalar Analyzer, 10MHz-40GHz $2000
Wavetek 8501, Peak Power Meter $2000
Wiltron 560-7S50, RF Detector, 10MHz-18.5GHz $300

MasterCard VISA

R & S Surplus
1050 E. CYPRESS STREET, COVINA, CA 91724
(626) 967-0846 · FAX (626) 967-1999

AST GLOBAL ELECTRONICS

24529 STATE HWY. 408, CAMBRIDGE SPRINGS, PA 16403
VOICE 814-398-8080 · 1-888-216-7159 · FAX 814-398-1176

VIEW COMPLETE LISTING AT: http://www.astglobal.com

IF WE DON'T CARRY IT ... WE'LL FIND IT QUICKLY ... AT REASONABLE PRICES.

EIP 545, Microwave Counter 18GHz $500
EIP 931, Microwave Source, .01-18GHz, Opt. 9320 SPECIAL $3,200
Fluke 845AB, Null Detector/Micro Voltmeter 1uV-1000VDC. $375
Fluke 5100B, Multifunction Calibrator, Opt. 03/05 ..... $2,800
Fluke 5100B, Multifunction Calibrator $2,400
Fluke 5200A, Programmable AC Calibrator $1,000
Fluke 5215A, Precision Power Amp $800
Fluke 6070A, Synthesized RF Signal Generator 200KHz-520MHz $1,400
Fluke 8050A, DMM 4-1/2 Digit w/Battery Pack $145
Fluke 8050A, DMM 4-1/2 Digit w/o Battery Pack $145
Fluke 8520A, DMM 5-1/2 Digit $275
Fluke 9010A, Micro System Troubleshooter $375
General Radio 1658, Digibridge $475
Gigatronics 6061A, Synthesized Signal Generator 10KHz-1050MHz $2200
HP 141T, Spectrum Analyzer Mainframe $475
HP 141T, Spectrum Analyzer w/8552A/8553B, 1KHz-110MHz .. $1,000
HP 141T, Spectrum Analyzer w/8552B/8553B, 1KHz-110MHz .. $1,200
HP 141T, Spectrum Analyzer w/8552B/8556A, 20Hz-300KHz .. $1,100
HP 141T, Spectrum Analyzer w/8552B/8554B, 1KHz-1.2GHz .. $1,700
HP 141T, Spectrum Analyzer w/8552B/8555A, 10MHz-18GHz .. $1,900
HP 334A, Distortion Analyzer $275
HP 400EL, AC Voltmeter, 10Hz-10MHz $150
HP 400FL, RMS Voltmeter, 20Hz-4MHz, 100uV-300V $175
HP 415E, SWR Meter $100
HP 432A, Power Meter w/Cable/8478, .01-18GHz Sensor $350
HP 436A, Power Meter w/8481H Sensor/Cable ..... SPECIAL $975

TURN IDLE TEST EQUIPMENT — INTO *CASH* — CALL OR FAX FOR QUOTATION

HP 436A, Power Meter, Opt. 002/009/022 w/8481H Sensor/Cable $1,200
HP 651B, Test Oscillator, 10Hz-10MHz $125
HP 652B, Test Oscillator, 10Hz-10MHz $125
HP 654A, Oscillator, 10Hz-10MHz, 90dB Attenuator $195
HP 1630G, Logic Analyzer w/pods $575
HP 1651A, Logic Analyzer $875
HP 3312A, Function Generator, .1Hz-13MHz $425
HP 3314A, Function Generator, Opt. 001 ..... SPECIAL $950
HP 3330B, Automatic Synthesizer, 20Hz-13MHz $295
HP 3400A, True RMS Voltmeter, 10Hz-10MHz, 1mV-300V $125
HP 3406A, RF Voltmeter, 50uV-3V, 1.2GHz $200
HP 3455A, DMM 5-1/2 Digit $250
HP 3456A, DMM 6-1/2 Digit $525
HP 3466A, DMM 4-1/2 Digit, AC/Battery, 5 Function $175
HP 3488A, Switch Control $450
HP 3551A, Portable Transmission Test Set $550
HP 3575A, Digital Phase Gain Meter 1Hz-13MHz $500
HP 3580A, Spectrum Analyzer, 5Hz-50KHz, LED Readout $650
HP 3580A, Spectrum Analyzer, 5Hz-500KHz, Mechanical $500
HP 3582A, Spectrum Analyzer, .02-25.5KHz $1,800
HP 3585A, Spectrum Analyzer, 20Hz-40MHz ..... SPECIAL $2,800
HP 3702B, IF/BB Receiver w/3705 Diff. Phase Detector $475
HP 3730B, Down Converter Mainframe $750
HP 3770A, Amplitude/Delay Distortion Analyzer $300
HP 3779B, Primary MPX Analyzer $500
HP 3781B, Pattern Generator $250
HP 4274A/Opt. 001, LCZ Meter ..... SPECIAL $2,400
HP 4959B, WAN Protocol Analyzer/J2213A $1,200
HP 4972A, LAN Protocol Analyzer $750
HP 5314A, Counter, 100MHz, Opt. 002, w/Manual, NICE! $175
HP 5314A, Counter, 10MHz, Opt. 001 (tcxo), NICE! $175
HP 5315B, Counter, 100MHz, Opt. 001, w/Manual, NICE! $275
HP 5315B, Counter, 1GHz, Opt. 001/003, w/Manual $425
HP 5316A, Counter, 100MHz, HPIB $350
HP 5328A, Counter, 100MHz w/DVM/Opt. 021 ..... $200
HP 5328A, Counter, 500MHz $250
HP 5334A, Counter, 100MHz, Opt. 010 Oven $500
HP 5340A, Counter, 18GHz (nixie) $600
HP 5345A, Counter, 500MHz $450
HP 5345A, Counter, 500MHz, HP-IB $650
HP 6101A, Power Supply, 0-20V @ 1A $125
HP 6104A, Power Supply, 0-20, 20-40V @ 2A, 1A $150
HP 6112A, Power Supply, 40V @ .5A (metered) $150
HP 6116A, Power Supply, 0-100V @ 200MA $150
HP 6177C, DC Current Source to 100V@500MA $275
HP 6202B, Power Supply, 40V @ .75A (metered) $150
HP 6203B, Power Supply, 7.5V @ 3A (metered) $150
HP 6205B, Power Supply (dual), 0-40V @ .3A, 0-20V @ 8A (metered) $175
HP 6206B, Power Supply, 0-60V @ 1A (metered) $200
HP 6212A, Power Supply, CV/CC, 0-100V @ 100MA $125
HP 6213A, Power Supply, CV/CL, 0-10V @ 1A $75
HP 6217A, Power Supply, CV/CL, 0-50V @ 200MA $100
HP 6218A, Power Supply, CV/CC, 0-50V @ 200MA $125
HP 6227B, Dual Tracking PS 0-25V @ 2A $375
HP 6260B, Power Supply, 10V @ 100A (metered) $300
HP 6264B, Power Supply, 0-20V @ 20A $225
HP 6265B, Power Supply, 40V @ 3A (metered) $200
HP 6266A, Power Supply, 40V @ 6A (metered) $200
HP 6266B, Power Supply, 0-40V @ 5A $275
HP 6289A, Power Supply, 0-40V @ 1.5A (metered) $175
HP 6294A, Power Supply, 0-60V @ 1A (metered) New in box w/manual $275
HP 8011A, Pulse Generator, .1Hz-20MHz $175
HP 8013B, Pulse Generator, 1Hz-50MHz $275
HP 8015A, Pulse Generator, .1Hz-50MHz 30V $400
HP 8016A, Word Generator, 50MHz $600
HP 8018A, Serial Data Generator $750
HP 8091A, Rate Generator (1GHz) w/8092A Delay Generator (1GHz) w/8093A Output Amp w/15401A & 15400A $1,000
HP 8160A, Programmable Pulse Generator, 50MHz, Opt. 001 ... $850
HP 8160A, Programmable Pulse Generator, 50MHz, Opt. 001/020 ..... $1,000
HP 8161A, Pulse Generator, 100MHz $1,500
HP 8165A, Programmable Sig Source, 1milliHz-50MHz $950
HP 8175A, Data Generator $1,750
HP 8443A, Tracking Generator, 1KHz-110MHz $275
HP 8445B, Auto Preselector, 1.8-18GHz $275
HP 8445B, Auto Preselector, 1.8-18GHz Opt. 002/003 ..... $375
HP 8601A, Sweeper Generator, .1-110MHz $400
HP 8614A, Signal Generator, 800-2400MHz, AM/FM Leveled $300
HP 8616A, Signal Generator UHF, 1.8-4.5GHz, +10-126dB, AM/FM $300
HP 8620C, Frame w/86222B Sweeper .01-2.4GHz $1,150
HP 86242D, RF Plug-in, 5.9-9.0GHz $225
HP 8640B, Signal Generator, .5-1050MHz, Opt. 002/001 or 003 $1,800
HP 8640B, Signal Generator, .5-512MHz, Opt 001 or 003 ..... $700
HP 8656A, Synthesized Signal Generator, 100KHz-990MHz $1,400
HP 8684D, RF Signal Generator, 5.4-18GHz $1,700
HP 8743A, Reflection Test Set, 2-12.4GHz $200
HP 8770A, Arbitrary Waveform Synthesizer $2,400
HP 8901A, Modulation Analyzer Opt. 010 ..... $875
HP 8901A, Modulation Analyzer. ..... SPECIAL $650
HP 59303A, D/A Converter $125
Kepco ATE15-50M, Power Supply, 0-15V @ 50A (metered) $500
Krohn-Hite 3202R, Dual Channel Tunable Filter, 20Hz-2MHz, High Pass, Low Pass Band Reject $200
National Instruments GPIB-100A, Bus Extender $175
Power Designs 2K-10 HV PS 1-2000V@10MA $375
Racal Dana 1991, Counter/Timer, 2 Channel $275
Racal Dana 1992, Counter/Timer, 1GHz $375
Rockland 1022F, Dual Hi/Lo Filter $125
Rockland 5100, Synthesizer, DC-2MHz, .001 Hz Resolution $325
Sencore CM2000, Computer Analyzer ..... SPECIAL $1,400
Sencore LC102, Capacitor/Inductor Analyzer $950
Sencore SC61, Scope (100MHz) w/New Probes, Dual Trace $750
Sencore SC61, Scope (100MHz) w/o Probes, Dual Trace $400
Sencore TVA92, TV Video Analyzer $1,100
Sencore VG91, Universal Video Generator $1,200
Sorenson DCR-80-5A, Power Supply, 80V @ 5A (metered) $375
Tek 7S14, Plug-in Sampling Plug-in, DC-1GHz $425
Tek AM501, Plug-in Op Amp $175
Tek AM502, Plug-in Differential Amp $225
Tek DC503, Plug-in Counter Universal, 100MHz $150
Tek DC509, Plug-in Counter, 135MHz, UNUSED $375
Tek DM502, Plug-in DMM $125
Tek DM502A, Plug-in DMM $125
Tek DM502, Plug-in DMM, 4-1/2 Digit $150
Tek FG504, Plug-in Function Generator, .001-40MHz $375
Tek PG501, Plug-in Pulse Generator, 5Hz-50MHz $175
Tek PS501-1, Plug-in Power Supply $150
Tek PS503A, Plug-in Power Supply Triple $175
Tek OIG-502, Plug-in Optical Impulse Generator (unused) $500
Tek T922, Scope (15MHz), Dual Trace, NICE! $175
Tek TM503, Power Module, 3 Slot $125
Tek TM504, Power Module, 4 Slot $150
Tek TM506, Power Module, 6 Slot $200
Tek TR503, Plug-in Tracking Generator, 100KHz-1.8GHz $575
Tek 2213, Scope (60MHz), Dual Trace $375
Tek 2215, Scope (60MHz) Dual Trace $450
Tek 2235, Scope (100MHz) Dual Trace $650
Tek 2236, Scope (100MHz) w/Counter/Timer/DMM $850
Tek 2246, Scope (100MHz) 4-Channel Cursor RO .. SPECIAL $1,200
Tek 2247A, Scope (100MHz) Dual Trace w/ Counter/Timer/Voltmeter ..... SPECIAL $1,400
Tek 2336, Scope (100MHz) Dual Trace ..... SPECIAL $525
Tek 2445, Scope (150MHz), 4-Channel Cursor Readout $1,100
Tek 2445A, Scope (150MHz), 4-Channel Cursor Readout $1,400
Tek 2465, Scope (300MHz), 4-Channel Cursor Readout $1,400
Tek 453, Scope (60MHz), Dual Trace $175
Tek 465, Scope (100MHz), Dual Trace $425
Tek 465B, Scope (100MHz), Dual Trace $475
Tek 466, Scope (100MHz storage), Dual Trace $575
Tek 475, Scope (200MHz), Dual Trace $475
Tek 475A, Scope (250MHz), Dual Trace $625
Tek 485, Scope (350MHz), Dual Trace $700
Tek 520A, NTSC Vectorscope $400
Tek 576, Curve Tracer ..... SPECIAL $1,400
Tek 7104, Scope (1GHz), Dual Trace $1,200
Tek 7104, Scope (1GHz) w/7A29, 7A29, 7B10 & 7B15 ..... $2,200
Tek 7844, Scope (dual beam) w/7A24, 7A26, 7B80 & 7B87 ..... $750
Tek 7904, Scope w/7A24, 7A26, 7B80 & 7B85 ..... $750
Tek 7904A, Scope w/7A24, 7A26, 7B80 & 7B85 ..... $825
Tek 7904A, Scope (500MHz) Frame $425
Wavetek 145, Pulse/Function Generator, .0001-20MHz $300
Wavetek 157, Programmable Waveform Synthesizer $425
Wavetek 1855, CATV Sweep/Transmitter $750
Wavetek 288, Synthesized Function Generator, 20Hz-20MHz (unused) $800
Wavetek 442, Dual Hi/Lo Filter, 1Hz-10KHz $400

VISA · MasterCard · DISCOVER NOVUS · AMERICAN EXPRESS

- 60-DAY WARRANTY
- 10-DAY RIGHT OF RETURN
- SATISFACTION GUARANTEED

Lowest Dealer Price Available

	5+	10+	20+
Refurb. Panasonic 145	$45	$40	$35
Regal w/Remote	$38	$35	$30
BC4535 86 Channel	$30	$28	$25
Oak Sigma 99 Channel	$45	$40	$35
75 Channel Converter	$18	$18	$18
Zenith ST1600 w/Remote	$75	$70	$65
Panasonic Converters Model-175 (550MHz)	$65	$55	$45

Six month's warranty on this model only

Call us today to satisfy all your cable equipment needs!

SAM'S ELECTRONICS
1-405-631-1856

All Cable Equipment is unmodified.

TECH FORUM

The audio amplifier tubes being used in guitar amps are in rather heavy demand, and this has driven the price of them up considerably. There are a lot of dealers for these tubes to be found on the Internet. For example, **Mojo Musical Supply www.mojotone.com/catindex.html** lists a number of tubes, transformers, and other parts needed to build and repair tube-type guitar amps. A lot of these same parts can be useful in the repair of old radio equipment, as well.

You should also visit any local hamfest, as many radio amateurs are also interested in old radio equipment, and you'll almost certainly be able to find an assortment of tubes (NOS and used) at any hamfest. Often, you'll find some nice old radio equipment for sale in the flea market division of most hamfests.

The American Radio League's monthly magazine *QST*, lists the location of hamfests all over the country every month, and there are usually several classified ads listing collectors who sell and buy tubes.

Other vendors of tubes include **http://st6.yahoo.com/thetubestore/index.html** This site is in Canada, but they have an extensive listing of tubes, which includes JAN/Philips military spec tubes, NOS, and various other manufacturers. They include a brief description of each tube type, where it was made, and some of the features/virtues of each particular tube. They apparently deliver tubes internationally, as well as to the US and Canada.

Another vendor of tubes and part, **www.vibroworld.com/parts/tech2.html** This site features "Tube Talk." Some interesting information about tubes in general. They are also dealers for Ruby Tubes Brand, a line of tubes that are made in China, Russia, Yugoslavia, and the Czech Republic. These tubes are selected and tested, and come with a six-month warranty. Ruby Tubes seem to have a better reputation than most Chinese tubes, in general. This company also stocks tube sockets, shields, and other hardware for guitar amps.

Dwight Johnson
Booneville, MS

#2

A check of the World Wide Web turned up these sites:
Electronic Tubes Online Shopping http://www.hlfin.com/shop/
Richardson Electronics http://www.rell.com/
Radio Electric Supply http://www.mindspring.com/
Also, my EEM catalog lists these suppliers:
BTC Electronic Components, Raleigh, NC; 919-878-5200.
Dearborn/LP, Wheeling, IL; 1-800-323-0198.
EEV, Inc., Elmsford, NY; 1-800-DIALEEV.
Penta Laboratories Div., Chatsworth, CA; 1-800-421-4219.
Richardson Electronics Limited, Lafox, IL; 1-800-348-5580.

Russell Kincaid
Milford, NH

#3 A good supplier of tubes that I have used in the past is **Tube World**, 2717 Superior Ave., Sheboygan, WI 53081; **920-208-0353** voice/fax.

A few others include: **ESRC**, 1599 S.W. 30th Ave., Unit 4, Boynton Beach, FL 33426; **561-737-8044** voice.

Vacuum Tubes, Inc., 3246 Floridale Ln., Cincinnati, OH 45239-6203; **513-385-3855** fax.

The Tube Store, **877-570-0979** voice.

John M. Hoyt
Easley, SC

#4 Alltronics, 2300-D Zanker Rd., San Jose, CA 95131-1114. **www.alltronics.com 408-943-9773** fax **408-943-9776**.

This company generally has a nice selection of new and used vacuum tubes. If you check through the classifieds section of this magazine, you are likely to find several other sources.

Robert Turner
Riverside, AL

Are you missing any issues of Nuts & Volts?

Back issues are available for only $5.00 each!

Call our orderline at 800-783-4624 and use your Visa or MasterCard.

Price includes First class postage.

TROPICAL HAMBOREE® SPONSORED BY DADE RADIO CLUB OF MIAMI, INC

40th TROPICAL HAMBOREE®
&
ARRL SOUTHEASTERN DIVISION CONVENTION
FEBRUARY 5 - 6, 2000
FAIR EXPO CENTER

S.W. 112 Avenue & Coral Way (S.W. 24th Street) • Miami, Florida
Hours: 9:00 - 5:00 Saturday • 9:00 - 4:00 Sunday
Registration: $5.00 Advance, $7.00 Door

FCC ENFORCEMENT BY RILEY HOLLINGSWORTH, K4ZDH
ARRL FORUM BY LEAGUE OFFICERS, DIRECTORS, SECTION MANAGERS
WASHINGTON SCENE REPORT • AMATEUR RADIO AROUND THE WORLD
FORUMS ON APRS, DX, SATELLITES, GPS
"HANDS-ON" NEW HAM DEMONSTRATIONS AND OPERATING TIPS
DADE COUNTY EMERGENCY RESPONSE TEAM DEMONSTRATION
TWO EXAM SESSIONS FOR ALL AMATEUR LICENSE CLASSES
ALTERNATIVE PROGRAMS ON CRAFTS, HEALTH & BEAUTY
PRIZES & SURPRIZES TO CELEBRATE OUR 40th ANNIVERSARY
MANUFACTURER AND DEALER BOOTHS, 850 SWAP TABLES
300 CAMPSITES ON SITE • FREE PARKING FOR 15,000 VEHICLES

Information on Booths, Tables, Campground & Application Forms
HAMBOREE HOME PAGE: http:..www.hamboree.org
DADE RADIO CLUB HOME PAGE: http://www.daderadioclub.org
Tel: 305-642-4139 or 305-226-5346 • Fax: 305-642-1648 • E-mail: w4wyr@arrl.net or wd4sfg@bellsouth.net

Newsbytes

Continued from page 11

Day, Halloween, Valentine's Day, Thanksgiving, Independence Day, and all of the major holidays.

You can change the number of lights, as well as their colors and blinking patterns. You can even display broken and burned-out bulbs. Twinkle Bulbs lets you select and play holiday music, either from its archive of songs, or from your own collection of MIDI files. The program includes a selection of seasonal and special-effect screen savers, as well as a Windows wallpaper changer.

Twinkle Bulbs is simple to install and use, and its control panel is easily accessed from the Windows system tray.

The Twinkle Bulbs 3.5 CD-ROM costs $24.95 and is available online from Barefoot Productions at http://www.barefootinc.com

A $1.00 donation from each sale will be made to the Make-A-Wish Foundation. Network and site licenses are available.

For more information, contact Barefoot Productions, 1101 W. Enclave Circle, Louisville, CO 80027; 303-665-7843, E-Mail: info@barefootinc.com

•

Subscribe to Nuts & Volts! Call 1-800-783-4624

PENNSYLVANIA RESIDENT HAS INVENTED AN INNOVATIVE PRODUCT KNOWN AS THE DISPOSABLE PHONE

This ingenious, new device permits the user to use as many as 200 minutes of calling time on a prepaid calling card without signing a contract, purchasing a cellular phone, or having to pay hidden fees or charges. Each disposable phone can initiate local and long distance telephone calls and is fully recyclable after use.

The disposable phone is a telephone with power controls, antenna, and a microphone-speaker unit. Disposable, recyclable alkaline batteries power it. Because the disposable phone is an inexpensive way to provide telephone service, it has almost limitless applications in today's busy and active world.

The disposable phone is ideal for anyone who needs quick, affordable phone service — from busy convention go'ers to traveling vacationers to working people on-the-go. This unique product also has applications for outdoor sportsmen such as hunters, anglers, boaters, and rafters, and for use in unexpected emergencies such as injuries or fire.

This product is currently in patent pending status and is available for outright sale or licensing arrangements. An exclusive licensing arrangement is available and details can be obtained by contacting the law offices of Fredric D. Abramson, 301-840-9733, fax 301-869-5636. E-Mail: FDAbramson@compuserve.com.

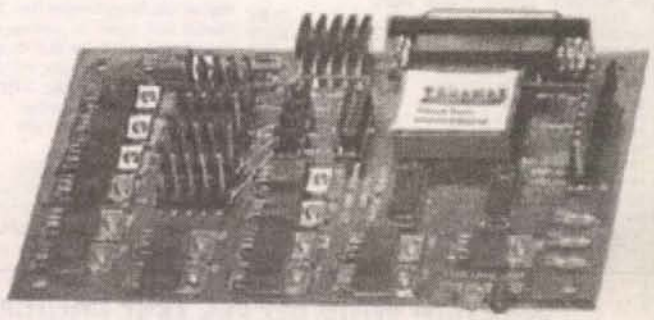
Continued on page 86

ADDRESSABLE STEPPER MOTOR CONTROLLER

The PARAMAX stepper motor controller is a PC parallel port based addressable controller capable of simultaneous operation of 4 uni-polar stepper motors ranging in voltages from 5 to 12 volts at up to 2 amps per phase. The PARAMAX stepper motor controller includes 8 digital inputs with a data through put rate of 500k bytes per second. Using the unique PARAMAX addressing method, up to 256 controllers can simultaneously function from a single parrallel port. The programming package includeslibraries that allow you to create applications both under Windows and DOS. Included libraries are: C++, Pascal, Delphi, Basic and utilities for DOS and Windows.

Also available at:
FORD ELECTRONICS, INC
(714) 521 - 8080

Part Number: JWP1X-1A
$199.95



PARAMAX INC.
(800) 473 - 8080
Come and visit us on the internet at:
www.paramax.net

ELECTRONIC TEST EQUIPMENT
BOUGHT & SOLD

30 DAY WARRANTY PARTS & LABOR • 10 DAY RIGHT OF RETURN, OPEN ACCOUNTS

Ailtech Type 32, Precision Attenuator, 0-100dB $300
Argosystems AS210, Frequency Calibration System ... $2,000
Austron 2110, Disciplined Frequency Standard $600
Bird 4381, RF Power Analyst, Opt. 832 ..... $200
Boonton 82AD, Modulation Meter $450
Boonton 92BD, Digital RF Millivolt Meter $250
Boonton 2500, DC Range Calibrator $250
Boonton 4G, Power Meter Sensor, .01-26.5GHz $200
Boonton 4300, Power Meter, 2 Channel $800
Bruel & Kjaer 1612, Bandpass Filter $250
Eaton 380K11, Frequency Synthesizer, 1-2000MHz $1,500
EIP 371, Source Locking Microwave Counter, 18GHz ... $1,000
EIP 578, Source Locking Microwave Counter, 26.5GHz.. $2,200
EIP 931, Microwave Source, .01-18.6GHz, Opt. 9320 ... $4,000
ESI 296, Auto LCR Meter $800
Fluke 515A, Portable Calibrator $800
Fluke 540B, Thermal Transfer Standard $500
Fluke 5450A, Programmable Resistance Calibrator..... $1,000
Fluke 6010A, Frequency Synthesizer, 10Hz-11MHz $300
Fluke 6071A, Synthesized RF Signal Gen.
Opt. 130,570,831,870 ..... $2,000
Fluke 6080A/AN Frequency Syn., .5-1024MHz $3,000
Fluke 8520A, Digital Multimeter $250
Fluke 8922A, True RMSVoltmeter $250
Fluke A55, Thermal Converter $200
General Microwave 478A, Peak Power Meter $700
General Radio 1557, Vibration Calibrator $400
Gigatronics 600/6-12, Frequency Synthesizer $1,000
Gigatronics 910, Frequency Synthesizer, .05-26GHz,
Opt. 03/06 ..... $6,000
Hitachi V-212, Scope, 20MHz, Dual Trace $200
HP 1122A, Probe Power Supply $200
HP 11590A, Bias Network $250
HP 11604A, Universal Extension $100
HP 11605A, Flexible Arm $100
HP 11638A, Calibration Kit, Type N $600
HP 11665B, Modulator $250
HP 11869A, Adaptor for Plug-In 8350A/B $350
HP 11970A, Harmonic Mixer, 26.5-40GHz $600
HP 11970K, Harmonic Mixer, 18-26.5GHz $600
HP 11970Q, Harmonic Mixer, 33-50GHz $600
HP 1630D, Logic Analyzer w/pods $300
HP 1630G, Logic Analyzer, 65 Channels $500
HP 16530A/16531A, Digital Scope Card,
16500A System $500
HP 214B, Pulse Generator $600
HP 33102A, Microwave Switch, 100MHz-18GHz $100
HP 3314A, Function Generator, Opt. 001 ..... $1,000
HP 3325A, Function Generator $800
HP 3325A/01/02, Function Gen., Opt. 01/02 ..... $1,200
HP 33322H, Programmable Attenuator, DC-18GHz $250
HP 3336C, Synthesizer, Level Generator $1,000
HP 3400A, RMS Voltmeter, 10Hz-10MHz $100
HP 3403C, True RMS Voltmeter $200
HP 3456A, Digital Multimeter $600
HP 35689A, S-Parameter Test Set for 3589A $1,400
HP 3575A, Gain/Phase Meter, Opt. 001 ..... $600
HP 3582A, Spectrum Analyzer, .02-25.5KHz $1,800
HP 4140B, Picoammeter, DC Source $1,500
HP 4274A, Multi-frequency LCR Meter, Opt. 001,002,003
HPIB, includes Test Fixture $2,000
HP 435B, Power Meter $350
HP 436A/022, Power Meter, HPIB $500
HP 5005B, Signature Multimeter $350
HP 5006A, Signature Analyzer $300
HP 5334A/020, Universal Counter w/DVM $600
HP 5335A/010, Frequency Counter $600
HP 5335A/030, Frequency Counter, 1300MHz $800
HP 5340A, Frequency Counter, 18GHz $600
HP 5340A, Frequency Counter w/Opt. 01/02/011 ..... $800
HP 5342A, Microwave Counter $1,000
HP 5345A, Frequency Counter, Opt. 012 ..... $300
HP 5350A/010/002, Microwave Frequency Counter..... $2,000
HP 54100D, Digital Scope, 1GHz $2,000
HP 54200A, Digital Storage Scope $800
HP 54601A, Digital Scope, 100MHz, 4 Channel $1,200
HP 6112A, Power Supply, 0-40V, 0.5A $200
HP 8015A, Pulse Generator, .1Hz-50MHz, 30V $500
HP 8165A, Programmable Signal Source,
.0001-50MHz $700
HP 8165A, Programmable Signal Source, Opt. 02/03..... $800
HP 8350A, Sweep Oscillator Mainframe $1,000
HP 8350B, Sweep Oscillator Mainframe $1,500
HP 83540A, RF Plug-In, 2-8.4GHz $1,200
HP 83545A, RF Plug-In, 5.9-12.4GHz..... $1,200
HP 8410C/8412B, Network Analyzer
w/8411A/Opt. 18, 18GHz $400
HP 8411A, Frequency Converters $250
HP 8414A, Polar Display $100
HP 8444A, Tracking Generator $500
HP 8445B, Spectrum Anyz., Automatic Pre-Selector $300
HP 8447E, Amplifier, .1-1300MHz, Gain 22dB $600
HP 8501A, Storage Normalizer, w/cable..... $800
HP 85033C, 3.5mm Calibration Kit $1,000
HP 8505A, Network Anyz. w/8501A & 8503A, Opt. 05... $3,000
HP 85021B, Directional Bridge, 10MHz-26.5GHz $1,200
HP 8557A, Spectrum Analyzer, .01-350MHz $800
HP 8559A, Spectrum Analyzer, .01-21GHz $2,000
HP 8559A/853A, Spectrum Analyzer, Digital,
.01-21GHz..... $3,000
HP 8569A, Spectrum Analyzer, 10MHz-22GHz $5,000
HP 86220A, RF Plug-In, 10-1300MHz $500
HP 86241A, RF Plug-In, 3.2-6.5GHz $400
HP 86260A, RF Plug-In, 12.4-18GHz $400
HP 86290A, RF Plug-In, 2-18GHz $1,200
HP 86290B, RF Plug-In, 2-18GHz $1,400
HP 8643A, Synthesized Frequency Generator $6,000
HP 8660C, Freq Syn w/86603A & 86635A, 2.6GHz..... $2,000
HP 86601A, RF Plug-In, 110MHz..... $300
HP 86602A, RF Plug-In, 1300MHz..... $500
HP 86603A, RF Plug-In, 2600MHz..... $800
HP 8672A, Frequency Synthesizer, 2-18GHz $4,500
HP 8684D, Signal Generator, 5.4-18GHz $2,000
HP 8697A, RF Plug-In, 26.5-40GHz..... $250
HP 8743A, Reflection Transmission Test Set $200
HP 8743A/018, Reflection Transmission Test Set, 18GHz . $300
HP 8750A, Storage Normalizer, Includes Cable $250
HP 8756A, Scalar Network Analyzer $1,500
HP 8901A, Modulation Analyzer $800
HP 8901B, Modulation Analyzer, Opt. 001,021 ..... $1,000
HP 8903A, Avon Analyzer, Opt. 001..... $500
HP 8903B, Audio Analyzer, Opt. 001..... $1,600
HP E3617A, DC Power Supply, 0-40V, 1A $250
HP P486A, Power Sensor, 12.4-18GHz $100
HP X486A, Power Sensor, 8.2-12.4GHz..... $100
Hughes 8010H, TWT Amplifier, 3-8GHz $800
Huntron 5100DS, Computer Controlled Troubleshooting
System..... $800
Keithley 192, Programmable DMM, 6.5 Digits, HPIB $600
Keithley 195A, Digital Multimeter $300
Keithley 614, Electrometer $700
Kikusui PLZ 72W, Electronic Load..... $200
Krohn-Hite 3202, Filter, LP, HP, BP, Unused $350
Leeds & North 1091, Capacitor Decade, .001uF-1uF $150
Micronetics NSI-52640W, Noise Source, 26.5-40GHz $350
Micro Sciences ICT-101, IC Tester..... $300
Ming HT-21, Handy IC Tester..... $100
Narda 5082, High Directivity Bridge, 2-18GHz $300
Narda 5292 Directional Coupler, 1-18GHz $200
Racal Dana 1515, Delay Pulse Generator $500
Racal Dana 1992, Frequency Counter, High Stab. $500
Simco A300, Aerostat Anti-static..... $100
Sorensen DCS-33-33, Power Supply, 0-13 volts
0-33 Amps $500
Tek 134, Probe Amplifier for P6021 & P6022 ..... $100
Tek 1470, NTSC Color Sync & Test Sig. Generator $500
Tek 1502, TDR with Battery Pack $1,000
Tek 1503/01/05, TDR, Scale in Meters $1,000
Tek 1503B, TDR with Opt. 03, Battery Pack $2,400
Tek 178, Linear IC Test Fixture, For 577 ..... $150
Tek 2245A, Scope, 100MHz, 4 Channels..... $800
Tek 2432, Scope, Digital, 300MHz, 4 Channel, HPIB.... $2,000
Tek 2445A, Scope, 150MHz, 4 Channel $1,200
Tek 2445B, Scope, 150MHz, 4 Trace, HPIB $1,500
Tek 305DMM, Scope, 10MHz, Dual Trace, DMM, battery . $500
Tek 318, Logic Analyzer w/accessories $500
Tek 338, Logic Analyzer..... $400
Tek 464, Scope, 100MHz Dual Trace, Storage $400
Tek 492, Spectrum Analyzer, Opt. 01/02 ..... $4,500
Tek 492/02, Spectrum Analyzer..... $4,000
Tek 492BP, Spectrum Analyzer $8,500
Tek 492P, Spectrum Analyzer, Opt. 01,02 ..... $5,000
Tek 576, Curve Tracer..... $1,800
Tek 577, Curve Tracer w/177 Fixture..... $1,000
Tek 604, XY Monitor $100
Tek 7D20, Programmable Digitizer PI $600
Tek 7S11, Sampling Unit w/S4 Head, DC-14GHz..... $800
Tek A610, Current Probe, 2-500 Amps..... $200
Tek DC503, Universal Counter Timer TM500 ..... $100
Tek DC504, Counter/Timer TM500 ..... $100
Tek FG501, Function Generator, 1MHz $100
Tek FG502, Function Generator, .1Hz-11MHz $250
Tek P6021/134, Current Probe w/Amp, 120Hz-60MHz $150
Tek P6046, Differential Probe..... $300
Tek P6202A, FET Probe, 500MHz unused..... $300
Tek P6602, Temperature Probe for DM5110, DM511 ..... $150
Tek PG506, Scope Cal System w/TG501, SG503,
New Style $1,500
Tek PG508, Pulse Generator, 50MHz $300
Tek PS503A, Dual Power Supply..... $150
Tek SC502, Scope, 15MHz, Dual Trace $200
Tek SG502, Sig. Gen. 5Hz-50KHz..... $200
Tek TDS410, Digitizing Oscilloscope, 150MHz..... $1,000
Tek TDS410A, Digitizing Scope, 200MHz, Opt. 13,1F ... $2,000
Tek TM503, 3 Slot Power Module..... $100
Tek WM490A, Waveguide Mixer, 26.5-40GHz $800
Tek WM490K, Waveguide Mixer, 18-26.5GHz $800
Texscan SSG2000, Freq. Syn., 100KHz-2GHz,
AM, FM $1,800
Ungar 4624, Solder, Desolder Station $250
Vu-Data 5110, Semiconductor Tester, In/out Circuit $150
Wavetek 115, Function Generator, .0015Hz-1MHz $300
Wavetek 130, Function Generator $200
Wavetek 178, 50MHz Programmable Waveform Syn. $1,000
Wavetek 180, Sweep/Function Generator $200
Wavetek 180, Sweep/Function Generator, .1Hz-2MHz $300
Wavetek 185, Sweep/Function Gen. .0001-5MHz $400
Wavetek 1084, Signal Gen. Sweeper, 3.5-4.5GHz..... $300
Wavetek 1910, XY Monitor, Dual Trace $400
Wavetek 452, Filter, Dual Hi/Lo, 1Hz-10KHz $450
Wavetek 907, Signal Generator, 7-11GHz $600
Wiltron 610D, Sweeper Mainframe..... $250
Wiltron 610D/6247D, Sweeper with
10MHz-18.5GHz Plug-in..... $400
Wiltron 6219D, RF Plug-In, 2-8GHz $200
Wiltron 6229D, RF Plug-In, 7.9-18.5GHz $300
Wiltron 62FF75, VSWR Bridge, 10-1000MHz $150
Wiltron 6NF50, Autotester, 1-1500MHz, for 640 ..... $100
Wiltron 7B50, Detector, 1-1500MHz, for 640 ..... $100

WANTED: YOUR EXCESS TEST EQUIPMENT

Turn your excess test equipment into cash!
Call or Fax your list for a quote.

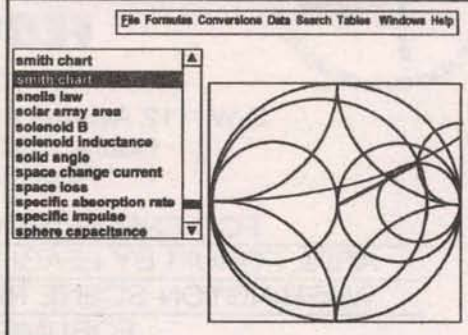
PHELPS INSTRUMENTS
2631 Hillside Ave., Norco, CA 91760
909-279-7347 • FAX 909-279-7323

MasterCard VISA

A DEGREE ON A DISK!

Electro Science Applications Inc.

EM FORMULARY



- 500+ formulas and simulations
- Unit conversions and data tables
- Physical constants
- Electronics, communications, radar
- Antennas, filters, optics
- Physics, math, space science
- Practical and educational

Self-contained and intuitive, you'll be up and running in minutes. Fast menu and hyper-linked access to equations and data. Current version 1.7 works with Windows 3.1, 95, or 98.

ELECTRO SCIENCE APPLICATIONS, INC.
P.O. BOX 11158, TORRANCE, CA 90510

To order, call (310) 539-2422 or E-Mail esa@earthlink.net
Send $29.95 check or money order (CA residents add 8.25% sales tax).
Foreign orders add appropriate shipping charge.

Electronic and RF design services also available.
Visit us at http://www.esap.com

Write In 199 on Reader Service Card.

Newsbytes

Continued from page 85

For additional information regarding this product, visit the disposable phone Website at: www.ipmginc.com/1186mf/index.html.

•

NEW BOOK AND CD-ROM DEMYSTIFY DIGITAL FREQUENCY SYNTHESIS

LLH Technology Publishing announces the publication of *Digital Frequency Synthesis Demystified*, a new book/CD-ROM package that focuses on the latest techniques in digital frequency synthesis, including direct digital synthesis (DDS) and fractional-N PLLs.

Written by Bar-Giora Goldberg, a noted expert in the frequency synthesis field, the book covers synthesis parameters and techniques, system analysis, DDS architecture, PLL synthesis, compression algorithms, and the latest IC synthesizers. Goldberg said, "I'm not aware of any other text that addresses the latest design issues in this exciting and fast-paced technology."

Frequency synthesis is used in cellular telephony, military radios, CB radios, consumer electronics, and other applications too numerous to mention. Recent advances in direct digital synthesis and PLL have made digital approaches extremely popular, and designers need to access the most current information possible.

LLH's president Carol Lewis describes the book and CD-ROM in this way: "Designers involved in the latest wave of devices making use of DDS will particularly appreciate this text. In addition to the excellent tutorial information in the book, the accompanying CD-ROM contains a variety of software tools and accessories to help designers understand and make use of the latest techniques in this exciting field."

Digital Frequency Synthesis Demystified is the newest volume in LLH's "Demystified" series for electronics engineers, which also includes the best-selling *Video Demystified*, now in its second edition. The new book/CD-ROM package sells for $49.95. It is available at bookstores and over the web at amazon.com. Contact LLH Technology Publishing at 540-567-2000; fax 540-567-2539; Web: www.LLH-Publishing.com.

We are looking for New Distributors for Nuts & Volts Magazine.

If you would be interested in selling Nuts & Volts in your store or on your newsstand, we have a great deal for you!

For complete information, ask for our New Distributor flyer.

Nuts & Volts Magazine
430 Princeland Court
Corona, CA 92879
phone 909-371-8497
fax 909-371-3052
E-Mail
distributors@nutsvolts.com

A Headset Junction Box

by Gerald Roylance

Have the convenience of a headset on your computer without the inconvenience of having to plug and unplug the speakers and microphone at the back of your computer.

Introduction

The audio card on my computer is a wonderful device, and I use it almost every day. Usually, the sound card output drives my speakers, but occasionally I want it to drive a headset with a boom microphone. The headset provides better fidelity with less background noise, and the boom mike is better for recording and speech recognition software. Headsets are more prevalent; two years ago I did not have any, but now I have four – three of which came bundled with software packages.

Unfortunately, using a headset means I have to unplug the speakers and microphone at the back of my computer, and then plug in the headset. Of course, the back of my computer is almost inaccessible, so I wanted an easier method of switching the speakers and headset. A box, some wire, and six jacks made a headset junction box (see Photo A) that makes the task trivial.

The back of my computer is almost inaccessible, so I wanted an easier method of switching the speakers and headset.

To appreciate how inaccessible a computer back plate can be, consider the number of connections on the back of my computer (see Photo B). First are the obligatory power, video, keyboard, and mouse cables. Add to that a SCSI cable for my scanner and a USB cable to a separate hub.

For communication with other computers, my computer has a telephone line and an ethernet cable. A parallel port cable connects the printer, and some exotic devices share a serial port cable. My PROM burner requires its own cable and ISA slot. The picture quality is not great, but there is an antenna cable for the TV tuner and a patch cord for TV sound (there are additional jacks for a VCR, but I have not used them yet). There would be more cables, but I have run out of ISA and PCI slots on the motherboard, so my DDS synthesizer gathers dust on the workbench. Finally, there are the sound card speaker and microphone cables, which are what this article is all about. It is a mess back there, and I avoid touching the cables lest something break.

The headset and microphone jacks should be convenient. My VCR got this right – it has convenient "Audio-Visual" inputs on its front panel so you can connect a camcorder without pulling the VCR off the shelf. The headset jacks should reside on the front of the computer or the front of my monitor instead of the jungle at the back of my computer, and the headset junction box lets me put them there.

Design

A simple solution is to extend the sound card jacks to a better

Electro Mavin

Great Buys - Great Products - Great Gadgets
Check Out Our Great WebSite at

http://mavin.com

For Computer Items, Hobbiest Projects, Microwave Goodies and Some of the Greatest Prices on the Web....

800-421-2442 or FAX 310-632-3557
E-Mail
john@mavin.com or mark@mavin.com

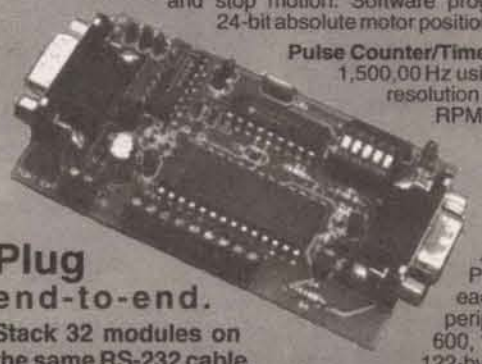
Weeder Technologies VISA MasterCard **RS-232 Stackable**

www.weedtech.com *Data Book Available* 850-863-5723

Digital I/O Module - 14 I/O pins individually configured for input or output. Turn on/off relays. Sense switch transitions, button presses, 4x4 matrix decoding using auto-debounce and repeat. One-shot pulse output with user programmable length. **$49**

Analog Input Module - 8 input pins. 12-bit plus sign self-calibrating ADC reads voltages from 0 to 4095 mV using 1 mV resolution. Supports single-ended, differential, or pseudo-differential modes. Software programmable alarm trip-points for each input. **$59**

Stepper Motor Driver - Drives a unipolar stepper motor rated up to 25VDC @ 2A. Uses automatic self-generated parabolic acceleration/deceleration curves for smooth start and stop motion. Software programmable ramp-rate and speed. 24-bit absolute motor position counter. Limit-switch input. **$59**



Pulse Counter/Timer - Read frequency from 0.50000 to 1,500,00 Hz using floating decimal point and 5-digit resolution throughout range. Measure period, RPM, duty cycle, pulse length, velocity of a projectile using a pair of trip wires. Accumulate pulse count. **$69**

Multi-Drop Peripheral Interface Plug a third-party RS-232 peripheral into the multi-drop bus. Appended header character allows PC to exclusively communicate with each of up to 32 devices. Supports peripheral baud rates of 75, 150, 300, 600, 1200, 1800, 2400 and 9600. Built-in 122-byte FIFO RAM buffer. **$59**

Plug end-to-end.
Stack 32 modules on the same RS-232 cable.

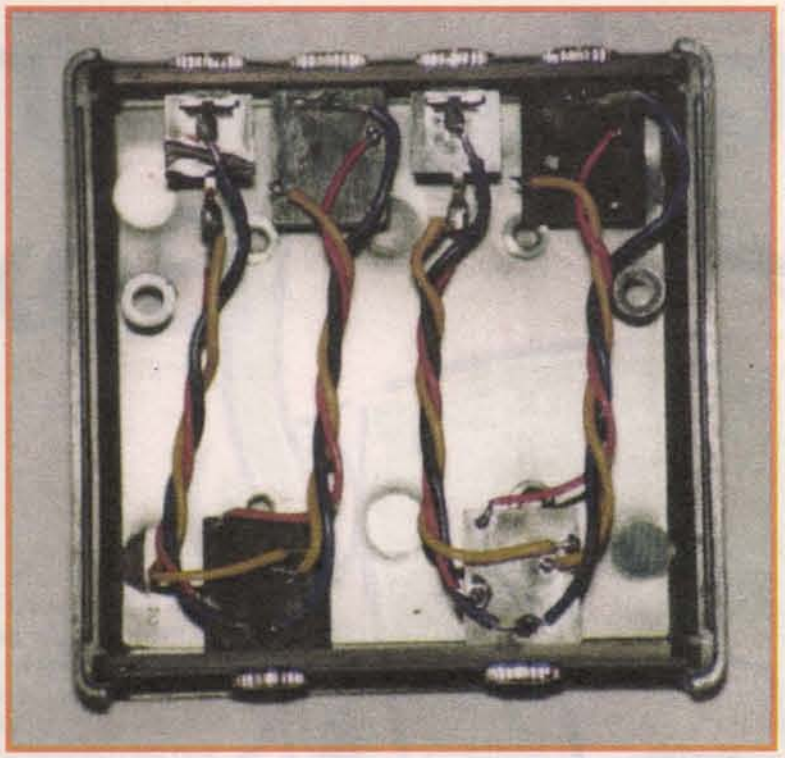
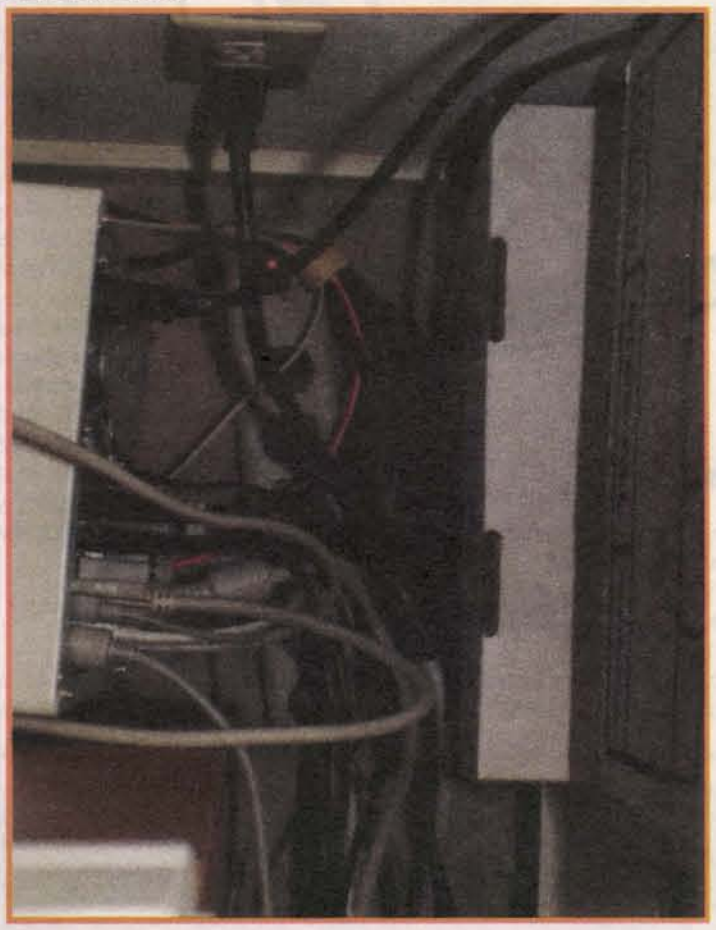


PHOTO A: Internal Wiring

PHOTO B: Rat's' Nest



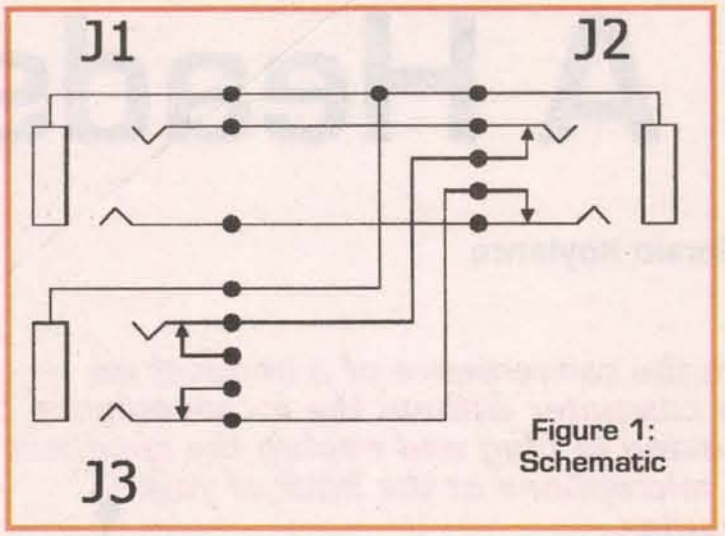


Figure 1: Schematic

location. When one wanted to use a headset, he could unplug his speakers and microphone and then plug in the headset. A slightly more clever arrangement avoids unplugging the original speakers and microphone – plugging in the headset would automatically disconnect the speakers. Many stereo receivers disconnect the speakers when the listener connects a headset.

Figure 1 shows the schematic for one circuit. The junction box uses two of these circuits: one for the speakers and one for the microphone. The basic idea is J1 (Sound Card) and J3 (Transducer – either the speaker or the microphone) are on the back of the junction box. J2 (Alternate Transducer) is on the front panel. Normally, the J1 connects to J3, so the sound card will interact with the usual transducer (speaker or microphone). Plugging an alternate transducer (speaker or microphone) into J2 not only connects the alternate transducer to the sound card, but it also disconnects the transducer at J3. The normally closed switches on J2 perform this feat.

Although a microphone is a monaural device, it still requires a stereo (three-wire) jack. The third wire supplies power for microphones with preamplifiers. The preamplifier boosts the signal level and minimizes the effect of electrical noise.

Construction

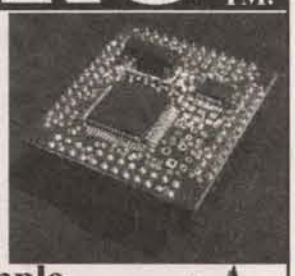
If you can, wire the box with shielded cable to minimize the electrostatic coupling between the two sides. Old sound card cables are a good source. I did not have any suitable cable in my junk box, so I twisted the wires together to minimize the magnetic coupling between the two circuits. Also, note that the wires go from J1 to J2 to J3 even though J1 and J3 are next to each

By the way, the terminals on a three-wire telephone plug (or jack) are the tip, ring, and sleeve. Just behind the plug tip is the ring, and the rest of the plug is the sleeve. The 3.5-mm plugs and jacks of a sound card are miniature versions of the original telephone connectors. The two wires of a telephone pair are tip and ring because they connected to the tip and ring terminals of the standard 0.25-inch telephone connector. Telephone switchboard operators used the connectors to complete calls.

UNI-MICRO™

Super-Small-Low Power

The NEW UNI-MICRO series of modules provides a complete ready to use single board computer on a 1.75" X 1.5" module with large amount of non-volatile flash based memory. Expanded capabilities, multiple serial busses, In-circuit programming, including first time programming and a very low power consumption of 58 mA, makes this series of modules perfect for instrumentation, monitoring and control applications.



Microcontroller Design Made Simple

Small • 80C51 code compatible • 256 x 8 ram • 2K x 8 Battery backed sram with automatic power switching • 128K x 8 Flash memory • Parallel or serially programmable • 32K x8 Flash memory • 3 16 bit timers • One 8 channel 10 bit A/D converter • Two 8 bit PWM outputs • One full duplex UART • 16 Mhz speed • 3000 gates flash CPLD • IIC serial bus • JTAG bus • 54 configurable I/O pins • RS232 driver on board • Voltage regulator on board • Power-on reset • Program security • Very low development costs • Asembly, C , Basic programmable.

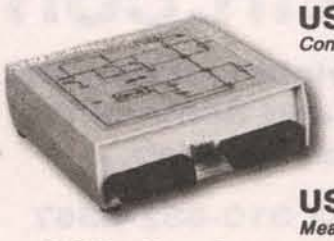
$59

OS Systems

908-979-1885 http://www.ossystems.net
1464 Route 57th, Port Murray, NJ 07865

Write in 185 on Reader Service Card.

Catch The Bus



USB Relay Module
Control 8 to 16 "form C", 1 Amp relays

USB Opto Module
8 to 32 opto-isolated Inputs and Outputs

USB Digital Module
Industry standard 50 pin interface

USB Temperature Module
Measures temperature over multiple remote sensors

J-Works, Inc
12328 Gladstone St., Unit 4
Sylmar, CA 91342
(818) 361-0787 Voice
(818) 270-2413 Fax

Visit our Web site for free information on all our products
http://www.j-works.com
E-mail sales@j-works.com

Write in 186 on Reader Service Card.

other. Each signal ground connection (sleeve) takes the long way around to minimize magnetic coupling.

I built the junction box in a plastic box to avoid connecting the signal grounds together (as explained above) and to keep the speaker and microphone circuits isolated. You can use almost any plastic case (Hammond Manufacturing generously donated the one I used). Do not use a metal box unless you also use isolated connectors. If the speaker and microphone grounds are connected together, then some of the speaker current will flow in the microphone ground lead, and that will impress a noise voltage on the microphone input.

The back panel jacks are spaced 0.5 inch apart. The front jacks are on one-inch centers. The holes are 15/64 inch for a tight fit.

Watch out! The diagrams that come with the RadioShack 274-249 3.5-mm jacks have problems. I blindly trusted the package data when I wired everything up. Later testing revealed that tip and ring were swapped, and the reason was the pinout diagrams on the blister pack were inconsistent. Time to pull out the soldering iron and make a few changes ...

Usage

Connecting the headset junction box is easy. I used two shielded stereo patch cords (RadioShack 42-2387) to go from my sound card to the J1 jacks on the junction box. The microphone cable should be shielded because the signals are low-level and high impedance, but the speaker cable does not require shielding for its high-level and low impedance signals. My speakers and area microphone plug into the J3 jacks on the back of the junction box. The junction box sits next to my monitor for convenient access (see Photo C).

To use a headset, I need only plug it into the appropriate jacks. Photo D shows the box with a headset plugged in; the box is pulled out to show all the connections.

One thing I do not like about the patch cords that go from the computer to the junction box is that both ends are male. When one end of the cable is connected, the other end is live and exposed. Accidentally shorting the speaker output to ground could damage the sound card, so be careful with the patch cords.

I like the arrangement because it is easy to connect the headset, and the headset has better sound quality than my speakers. Of course, the headset has better frequency response than my cheap speakers, and also blocks out the dull roar of my computer fan. A headset mike is also more convenient than one located on a desk. Good luck. **NV**

PHOTO C:
Junction Box Sitting Next to Monitor

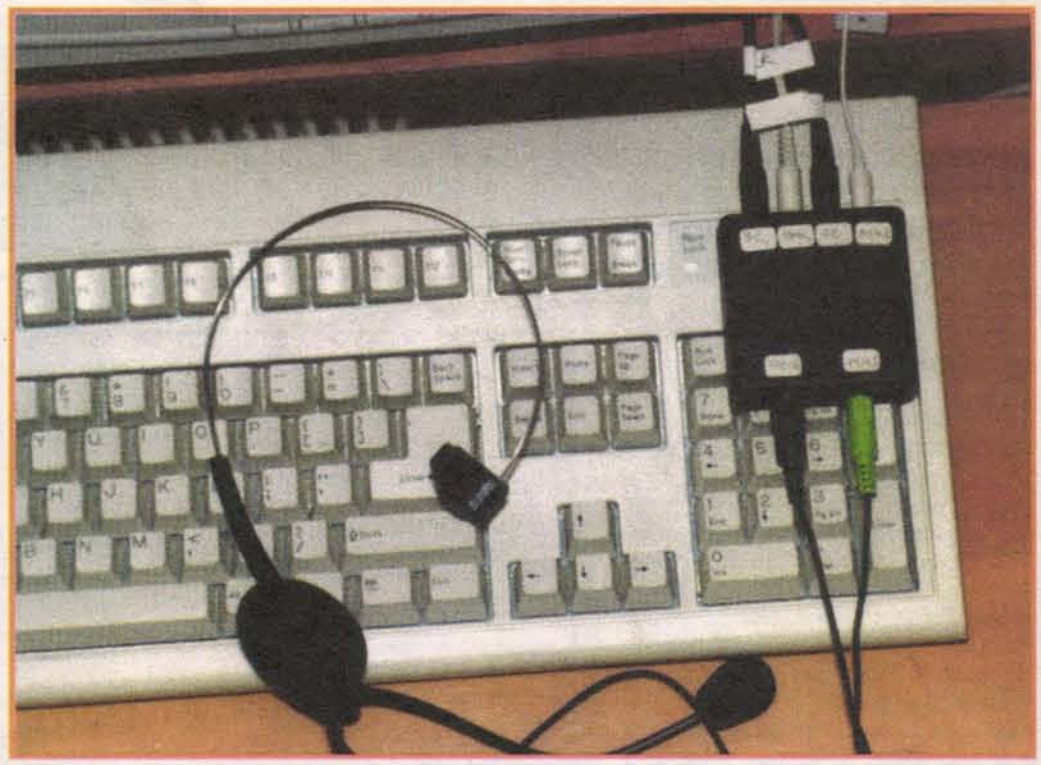


PHOTO D:
Connection of Cables and Headset

Parts

Plastic case, Hammond Manufacturing 1593KBK.
For each circuit (two circuits required: one for the microphone and one for the speaker)
J1 3.5-mm Stereo Phone Jack, *RadioShack 274-249*
J2, J3 3.5-mm Stereo Phone Jack with NC switches, *RadioShack 274-246A*

J3 could be the same as J1. I used a jack with NC switches so I could terminate the microphone input when J2 and J3 are unmated. The termination would minimize noise pickup on an open line, but I have not added the resistors yet.

$$ BEST DEALER PRICE & SERVICE $$

Converters:	10+	50+	100+
♦ **ViewMaster VM-3800** 125 Ch Plain Converter, PG Lock HRC/STD	$75	$70	Call
♦ **Panasonic TZPC-175** 99 Ch Plain Converter, PG Lock HRC/STD	$50	$45	Call
♦ **Centurion CF-3000** 99 Ch Plain Converter, PG Lock HRC/STD	$55	$50	Call
Remotes:			
♦ **Jerrold 400,450,550, CFT**	$4.95	$4.50	Call
♦ **SA 175,475, 8600**	$4.95	$4.50	Call
♦ **Zenith, Tocom, Pioneer**	$4.95	$4.50	Call

$$ TNT ELECTRONICS • (405) 692-4982 $$

Write in 187 on Reader Service Card.

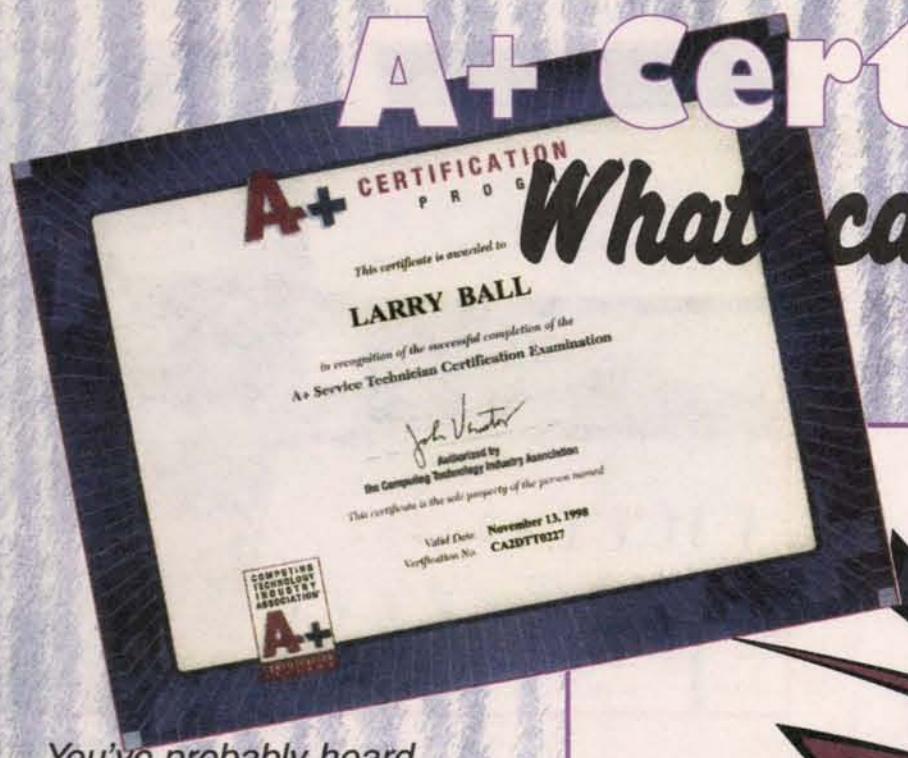
THERE IS A FREE LUNCH AFTER All – 500 resistors sent absolutely free with order of $10.00 or more. Sell them to your friends for 1¢ or 2¢ and treat yourself to a $5.00 or $10.00 lunch! Spend $25.00 and we'll send 1,500 (Lunch for 2).

ER Digital Multimeter	$17.95	1N4005 (600V-1A) (100)	$4.95
ER Analog Multimeter	6.95	1N914 (75V-10mA) (100)	2.95
SO-239 Connector	.95	1N4148 (75V-10mA) (100)	2.95
PL-259 Connector	.95	2N3904 (NPN) (100)	8.00
6-pc Precision Screwdriver Set	1.50	2N3906 (PNP) (100)	8.00
10 Pair Alligator Clip Leads	2.95	2N3055 (NPN) GP	.65
10 T 1 3/4 LEDs (green, red, yellow)	1.25	2N5239 (NPN) HV GP Amp	1.50
12V - 60Amp Starter Switch	9.50	2N5684 (PNP) 50A-300W Hi-Pwr Amp	3.00
Pocket Telescoping Magnet	2.95	2N5686 (NPN) 50A-300W Hi-Pwr Amp	3.00
40-pc Carbon Steel Tap & Die Set	19.95	Set of 4 Wax Carvers/Picks	3.95
AA Ni-Cad Battery	.95	6" Plastic Vernier Caliper	1.50
1# 60/40 Solder	7.95	Pad of 56 Stick-on Feet	2.50
30W Solder Iron	2.95	4" Black Tie Wraps (100)	2.50
XLR-3 Pin Male Connector	2.00	12-1/2W - 1.5K Rheostat	4.75
XLR-3 Pin Female Connector	2.25	50V-2A Bridge Rectifier	.75
Mini Toggle Switch SPDT On-Off-On	.50	2-Way Splitter (5-900 MHz)	.95
Mini Toggle Switch DPDT On-Off-On	.60	RJ45 Connector	.25
Full Size Toggle DPDT 15A-3/4 HP	2.00	Banana Plugs (Red or Black)	.30
3-Wire Trailer Connector (M&F)	3.25	Universal 1 Amp AC/DC Adapter with 7 Different Voltages	4.95
4-Wire Trailer Connector (M&F)	3.95		
Mini Snap-in Rocker Switch 6A	.45		
1N4001 (50V-1A) (100)	4.95		

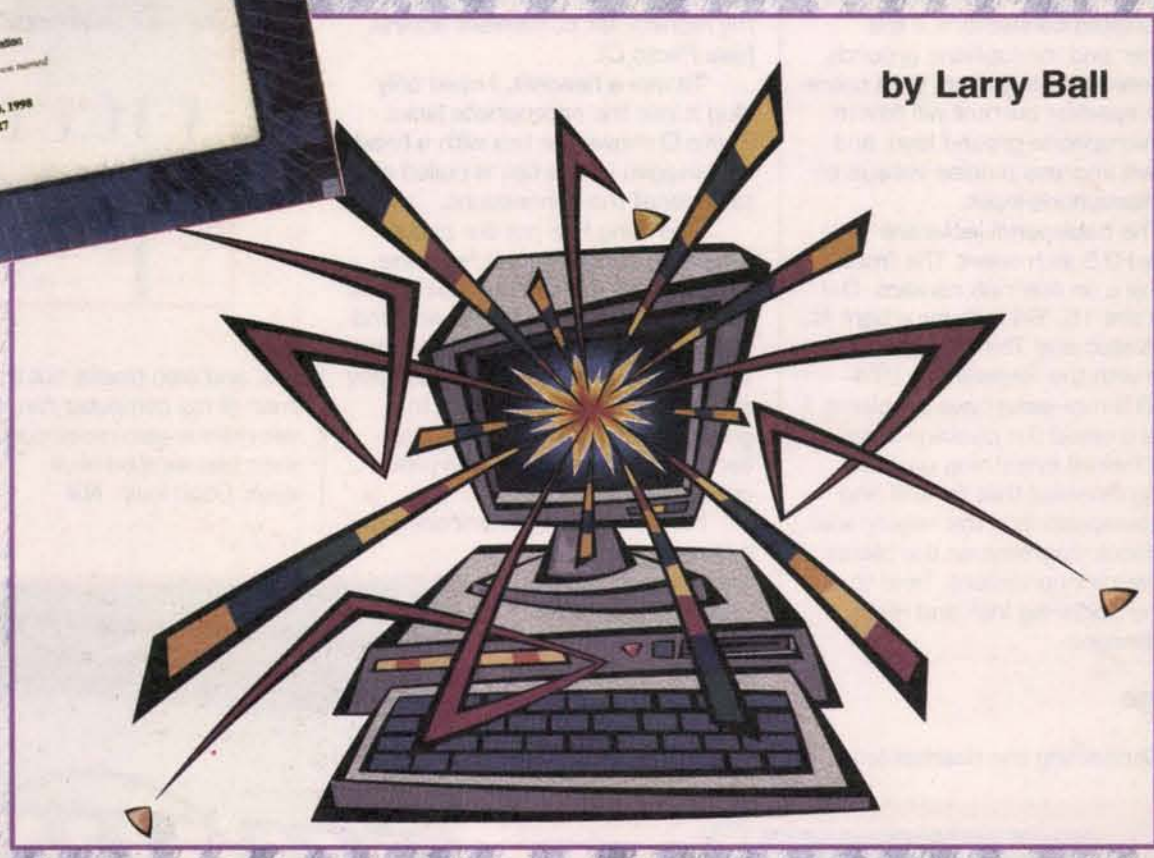
Add $3.50 for shipping and handling. CA Buyers add 7.75% Sales Tax.

HYATT ELECTRONICS, 371 N. Johnson Ave., El Cajon, CA 92020
Tel. **(619) 444-2434** • Fax **(619) 444-1987**

A+ Certification — What can it do for you?



by Larry Ball



You've probably heard of the A+ certification for computer technicians. ***But what can it do for you?***

It can be your ticket to better pay, better jobs, and more promotions.

You needn't look any further than your local want ads to see that A+ certification is fast becoming a requirement to "get your foot in the door" when it comes to PC-related jobs.

There are even some high paying computer network support jobs which require A+ certification (as well as other certifications).

A+ certification is supported by a virtual "Who's Who" of major hardware and software manufacturers and dealers. When Microsoft, Intel, Compaq, Hayes, Hewlett Packard, IBM, Tandy, CompUSA, Packard Bell, Digital Equipment Corporation, and over a dozen other companies support a certification, you know it has credibility! In fact, some of these companies refuse to hire technicians for certain positions if they lack A+ certification. This seems to be the trend in the computer industry. More and more companies are requiring it for their employees.

The testing program is sponsored by the Computing Technology Industry Association (CompTIA). It's administered by Sylvan Prometric and anyone can take it. So let's take a closer look at what it takes for you to join the over 100,000 technicians who have already earned the A+ certification.

The Test

The A+ test consists of two examinations: The core objectives and the DOS/Windows objectives. They can be taken separately or together, but must be taken within 90 days of each other.

The tests reflect the knowledge that a person with six months experience in

CompTIA
450 E. 22nd St., Suite 230
Lombard, IL 60148
(630) 268-1818
www.comptia.org
A+ Certification information

DataTrain Institute
309 5th Ave., Rm. 300-1
New York, NY 10016
(800) 832-8287
www.datatraininst.com
computer-based practice tests

Forefront Direct
25400 US Hwy. 19N, Suite 285
Clearwater, FL 33763
(800) 653-4933
www.ffg.com
computer-based self-study kits

Heathkit Educational Systems
455 Riverview Dr.
Benton Harbor, MI 49022
(800) 253-0570
www.heathkit.com
self-study kits

ICS Learning Systems
925 Oak St.
Scranton, PA 18515
(800) 465-5155
www.icslearn.com
self-study courses

InfoSource, Inc.
6947 University Blvd.
Winter Park, FL 32792
(800) 393-4636
www.infosourcenet.com
self-study kits

Macmillan Computer Publishing
201 W. 103rd St.
Indianapolis, IN 46290
(800) 716-0044
www.mcp.com
self-study books with CDs

Marcraft International Corp.
1620 E. Hillsboro St.
Pasco, WA 99301
(800) 441-6006
www.mic-inc.com
self-study kits

Micro2000, Inc.
1100 E. Broadway, Suite 301
Glendale, CA 91205
(800) 864-8008
www.micro2000.com
self-study kits

MindWorks Professional Education Group, Inc.
4141 N. Granite Reef, Suite 101
Scottsdale, AZ 85251
(800) 874-1516
www.mindwork.com
self-study kits

New Horizens Computer Learning Centers, Inc.
1231 E. Dyer Rd., Suite 110
Santa Ana, CA 92705
(714) 432-7600
www.newhorizens.com
worldwide local computer training

NRI School of Electronics
4401 Connecticut Ave. NW
Washington, DC 20008
(202) 244-9792
www.nrischools.com
PC repair course with A+ training

Self Test Software, Inc.
4651 Woodstock Rd.
Suite 203, M/S 384
Roswell, GA 30075
(800) 244-7330
www.stsware.com
computer-based practice tests

Specialized Solutions, Inc.
338 E. Lemon St.
Tarpon Springs, FL 34689
(800) 942-1660
www.specializedsolutions.com
self-study kits

Sybex, Inc.
1151 Marina Village Pkwy.
Alameda, CA 94501
(510) 523-8233
www.sybex.com
A+ certification books with CDs

Sylvan Prometric
(800) 776-4276
contact to schedule A+ certification tests

Total Seminars
10733 Gulf Fwy.
Houston, TX 77034
(800) 446-6004
www.totalsem.com
self-study kits

Wave Technologies Int'l., Inc.
10845 Olive Blvd., Suite 250
St. Louis, MO 63141
(800) 423-9065
www.wavetech.com
self-study kits

Sample Questions A+ Core Examination

One reason for an incorrect time/date setting could be
A. low power supply voltage
B. low CMOS battery
C. low disk space
D. a bad UPS
Correct answer: B

Which type of connector is used for a parallel connection on a printer?
A. Centronics (36-pin) D-Shell
B. 25-pin (DB-25) male
C. 25-pin (DB-25) female
D. 9-pin (DB-9) male
Correct answer: A

Which statement is true regarding SCSI termination?
A. Only drives must be terminated.
B. Only adapters must be terminated.
C. No termination is necessary.
D. Both ends of the chain must be terminated.
Correct answer: D

External modems are usually connected to a(n)
A. SCSI port
B. LPT port
C. serial port
D. parallel port
Correct answer: C

The major advantage of using Flash ROM is
A. you can upgrade BIOS without replacing the chip
B. you do not have to re-load the operating system
C. hard drives are protected
D. memory capacity is increased
Correct answer: A

A 10BaseT cable is normally connected to a computer with a(n)
A. BNC connector
B. TX connector
C. RJ-11 connector
D. RJ-45 connector
Correct answer: D

Figure 1 — These questions are typical of what you might find on the A+ Certification Core examination. *This information is from the CompTIA web site and is copyright 1999 by CompTIA.*

Sample Questions A+ DOS/Windows Examination

Which two files make up the Registry in Windows 95?
A. CONFIG.SYS and AUTOEXEC.BAT
B. COMMAND.COM and CONFIG.SYS
C. MSDOS.SYS and IO.SYS
D. USER.DAT and SYSTEM.DAT
Correct answer: D

Which file starts programs automatically when Windows 3.1 starts?
A. WIN.INI
B. SETUP.INI
C. SYSTEM.INI
D. SYSTEM.DA0
Correct answer: A

A(n) ___ partition must exist on the hard drive in order to install Windows 95.
A. CDFS
B. HPFS
C. FAT
D. NTFS
Correct answer: C

The memory addresses from 0 to 640KB are known as
A. common memory
B. high memory
C. expanded memory
D. conventional memory
Correct answer: D

Which protocol does the Internet use?
A. DLC
B. IPX/SPX
C. TCP/IP
D. NetBEUI
Correct answer: C

Figure 2 — These questions are typical of what you might find on the A+ Certification DOS/Windows examination. *This information is from the CompTIA web site and is copyright 1999 by CompTIA.*

What is one way to recover from the error message "No operating system found" when starting Windows 95?
A. Insert a CD-ROM with the system files and run the SYS command.
B. Reboot on a floppy with system files and use the FORMAT C: /F command.
C. Insert the Windows 95 CD-ROM and use the FORMAT C: /F command.
D. Reboot on a floppy with system files and use the SYS C: command.
Correct answer: D

the computer service field should have. Some of the questions are about basics (like recognizing the components on a motherboard), but most are very specific. Figures 1 and 2 contain sample A+ exam questions. These questions are from the compTIA web site and are similar to what you might see on the tests.

Unless you're a working computer technician with a broad understanding of PC hardware and software, it's wise to study. Of course, novices will need to study more than experienced technicians. You're expected to be familiar with general concepts, as well as specific details. The test's goal is to find out if you have the "hands on" knowledge needed to repair and maintain PC hardware and software.

When taking the examinations, you can expect to be tested on IRQs, displays, operating systems, storage media, printers, modems, expansion busses, installing and upgrading (both hardware and software), problem diagnosis, preventive maintenance, interaction with customers and safety, as well as other areas.

See Figure 3 for an idea of the content of the A+ examinations. Visit CompTIA's web site (www.comptia.org) or request their "candidate information" brochure to learn more about the specific information covered in the tests and to obtain more information on how to sign up. Unlike many tests, the A+ certification examinations aren't taken with a pencil and paper. They're taken on a computer.

You should arrive 15 minutes early so that you can identify yourself to the test administrator, then you'll have an opportunity to learn how the use the computer-based testing system before the actual test begins. Take advantage of this opportunity. Don't waste your valuable test time learning how the testing program works. One advantage of this format is that as soon as you finish the test, you receive your final score!

The Core examination has 69 questions and requires a score of 65% to pass; the DOS/Windows examination has 70 questions and requires a score of 66% to pass. You're allowed one hour to complete the Core examination and one hour and fifteen minutes for the DOS/Windows examination.

Preparing for the Test

How much you'll need to study for the A+ certification test depends on your level of PC hardware and software expertise. Even if you think you have the test "in the bag," studying will broaden your knowledge and make you a better technician.

World Passing You By?

Are you interested in Microprocessors & Embedded Control Systems? If not you should be! Look around, just about everything these days has an embedded microprocessor in it. TVs, cars, radios, traffic lights & even toys have embedded computers controlling their actions. The Primer Trainer is the tool that can not only teach you how these devices operate but give you the opportunity to program these types of systems yourself. Examples & exercises in the Self Instruction manual take you from writing simple programs to controlling motors. Start out in Machine language, then move on to Assembler, & then continue on with optional C, Basic, or Forth Compilers. So don't be left behind; this is information you need to know!

Examples Include:
- Measuring Temperature
- Using a Photocell to Detect Light Levels
- Making a Waveform Generator
- Constructing a Capacitance Meter
- Motor Speed Control Using Back EMF
- Interfacing and Controlling Stepper Motors
- Scanning Keypads and Writing to LCD/LED Displays
- Bus Interfacing an 8255 PPI
- Using the Primer as an EPROM Programmer
- DTMF Autodialer & Remote Controller (New!)

The PRIMER is only $119.95 in kit form. The PRIMER Assembled & Tested is $169.95. This trainer can be used stand alone via the keypad and display or connected to a PC with the optional upgrade ($49.95). The Upgrade includes: an RS232 serial port & cable, 32K of battery backed RAM, & Assembler/Terminal software. Please add $5.00 for shipping within the U.S. Picture shown with upgrade option and optional heavy-duty keypad ($29.95) installed. Satisfaction guaranteed.

EMAC, inc.
11 EMAC WAY, CARBONDALE, IL 62901
618-529-4525 Fax 457-0110 BBS 529-5708
World Wide Web: http://www.emacinc.com

1985 - 1998 OVER 12 YEARS OF SERVICE

Write in 151 on Reader Service Card.

Programmers Designers Engineers Hackers

Are you an *expert* with Microchip's® PIC® Microcontroller Series?

If you're really good at writing .asm code using MPLAB and MPASM for the 16C/F series and have a strong electronics background in digital circuits, you are invited to use your talents and possibly do some design work for us.

We're a multi-million dollar international electronics company in search of a few good independent subcontractors who can work at home to help us develop some brand new products for the security industry, on a *fast track* basis. If you already have some neat products you think we may be interested in, let us know.

Please send your complete technical qualifications and a detailed list of abilities and achievements to: glenn@corby.com and be sure to put "NV99" in the subject header.

Corby access control systems

Learning something relevant is never a waste of time. You can find study guides published by Sybex, MacMillian, or other quality publishers in larger book stores (such as "Books a Million"). If you can't find training materials (or an A+ certification training center) locally, you'll have to find training via mail order.

Mail Order A+ Training

A multitude of companies sell A+ training via mail order, and their formats vary significantly. We'll look at some of them so that you can get a better idea of what's available. There are many considerations when purchasing such materials, but price, quality, and format seem to be the most obvious ones.

Price

The price of A+ training varies from less than $100.00 to well over $2,000.00. At the low end of the scale is the $85.00 "A+ Certification Kit" published by Sybex and available in local bookstores and through the mail. It consists of two books and two CDs. At the high end of the scale is a complete PC servicing course available from NRI for $2,100.00. It includes books, software, full subject matter support, a digital multi-meter, and Pentium II computer.

Most A+ self-study kits fall in the $400.00 to $800.00 range with the majority near $600.00. For the budget-minded, Marcraft and Mindworks offer self-study kits for less than $200.00.

Quality

When shopping via mail order, quality is the most difficult factor to judge. No matter how well a brochure is written or how specific a salesman is, you can't see the actual study materials until you've purchased them. Some training vendors have found ways around this problem.

Mindworks and Forefront will allow you to download a free sample of their training software from their web sites.

Micro2000 will send you a demo CD and Marcraft will mail you a sample chapter from their primary training text and lab manual. If you're serious about getting training, you should get these samples. There's no substitute for seeing what you'll be paying for. Some vendors' web sites include free samples of training software and practice test questions.

Visit the web sites listed in the addresses sidebar to see what they're currently offering.

Format

While quality is the most difficult factor to ascertain when shopping mail order, format is the most confusing. Each company has a different product which (hopefully) consists of different parts. Some vendors sell training in book form only, while others may sell only practice questions on floppy disks. Training packages may consist of books, software, videos, sophisticated test equipment, subject matter technical support, or even a new computer. This makes an "apples-to-apples" comparison impossible. You'll need to narrow the comparison criteria.

The first question you should ask yourself is "what kind of training do I need?" If you lack hardware experience, you should purchase a course which includes hands-on hardware training. It's possible to pass the A+ test without ever having touched the inside of a computer, but a lack of such experience will prove to be an embarrassment on the job.

Once you've decided whether or not you need hardware training, your next format choices will be between computer-based and/or textbook-based training. Each one has advantages and disadvantages.

Skills Tested in Core Examination	Approximate % of Representation
Installation, Configuration and Upgrading	30%
Diagnosing and Troubleshooting	20%
Safety and Preventive Maintenance	10%
Motherboards, Processors, Memory	10%
Printers	10%
Portable Systems	5%
Basic Networking	5%
Customer Satisfaction	10%

Note: The customer satisfaction portion of the test will be scored but will not impact the final pass/fail core of the Core examination.

Skills Tested in DOS/Windows Examination	Approximate % of Representation
Function, Structure, Operation, and File Management	30%
Memory Management	10%
Installation, Configuration and Upgrading	30%
Diagnosing and Troubleshooting	20%
Networks	10%

Note: Approximately 75% of the test items will relate to Windows 95 and approximately 25% will relate to DOS and Windows3.x.

Figure 3 — The A+ examinations cover some areas much more thoroughly than others, you should study accordingly.
This information is from the CompTIA web site and is copyright 1999 CompTIA.

Computer-based training can be interactive and can simulate what happens when you execute certain software commands (or may even simulate software failures). Some companies provide software which links the answers on their practice test to their training text so that you can immediately find more information about questions you don't fully understand. Computer-based training might also include digital videos. Finally, only computer-based training can simulate the actual test conditions you'll encounter when you take the A+ certification test.

Computer-based training has many advantages, but it has one disadvantage. Given a choice, many (if not most) people prefer reading hard copy text rather than computer text.

Some of these programs include 1,000 pages (or even several thousand pages) of text and graphics. Also, unless your computer is a laptop, books are more portable. Ideally, you should buy a training program which includes both written text and computer software. Most vendors offer such training packages. Marcraft includes their entire training program in both text and software format. That's the best of both worlds.

Another point which needs to be made about format is the number of practice test questions. It's impossible to gauge your learning progress if you inadvertently memorize the answers to the practice questions. You'll want as many practice questions as possible.

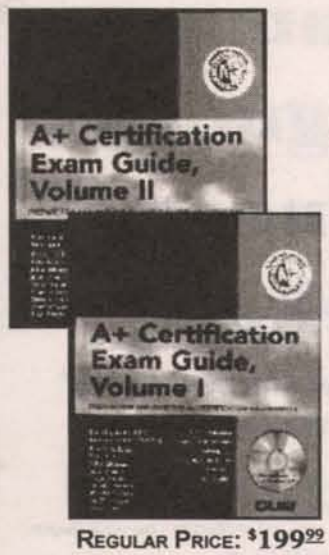
With all the different training formats available, some vendors have chosen to compare their products to other companies' products by using comparison charts. Comparison charts can be helpful, but they're also deceptive. Remember: The reason for the chart's existence isn't to help you compare products, it's to make the vendors' product look good. Take a close look at the categories and use your own judgement. Ask yourself "Are these categories important or are they marketing hype?" Most vendors' comparison charts contain both useful and useless comparisons. Read them carefully.

Get the Latest Information

Like everyone else in the computer field, training vendors are constantly updating and improving their products. The pace of change in the A+ training field is dizzying. For the most current information and prices, contact the companies listed in the sidebar.

How to Register

To register for the test, contact Sylvan Prometric at 1-800-776-4276, or if you have questions, call CompTIA at 630-268-1818. The cost of taking both portions of the test varies, but for most individuals in North America it's $256.00. Several discounts are available; visit CompTIA's web site or call them to see if you qualify. **NV**



REGULAR PRICE: $199.99

SPECIAL $129.95

They Wrote The Book

The A+ Certification Exam Guide was developed by IBM, the company which set the standard for Personal Computing. It consists of two large volumes and a CD-ROM disk.

If your goal is to become a certified Computer Service Technician, the Guide is the only reference you should need to successfully prepare for the certifying exam. Over 2,000 pages, it is thorough, yet not cumbersome to use. And once you become a certified Technician, it is still useful as a reference.

The A+ Certification Exam Guide was written by training-education specialists with the experience necessary to guide you through the information that is key to passing the exam. Difficult concepts are clearly explained, and topics and skills stressed on the exam are pointed out. In addition, the volumes include helpful graphics, diagrams, tables and charts.

The CD-ROM disk, which is part of the two volume set, not only contains the entire contents of both volumes, but also, hundreds of very useful sample test questions. There are also Self-Assessment sections at the end of each chapter in the Guide.

This 2-volume set is also a tremendous reference work for anybody who wants to know how PCs work or what to do when they don't work.

The A+ Certification Exam is sponsored by CompTIA.

This special price won't last long!!!

ORDER NOW!!!

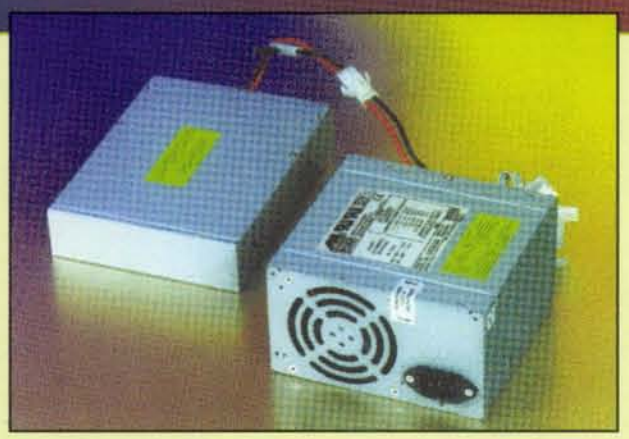
800-854-7393

WEBSITE: www.graymarkint.com

Graymark®

Write In 73 on Reader Service Card.

New Product News



BUILT-IN UPS MPS1058 SERIES

Magnum's new MPS1058 series of built-in UPS offer full protection against line voltage failures and interruptions.

Housed in standard ATX and PS/2 cases, they directly replace a conventional switching power supply at the heart of a computer or other power sensitive equipment.

The unit functions as a normal power supply when AC power is present and as a true on-line UPS during periods of power failure.

Energy is stored for back-up operation within a small battery pack mounted in a spare disk drive slot or other suitable location within the host system.

Principal advantages over conventional forms of UPS include low cost, high efficiency, high reliability, environmental friendliness, enhanced system security, and the elimination of external cabinets and interconnections.

MPS1058 offers 200W of output power and is capable of operating in industrial and other hostile environments.

All units are fully safety approved and incorporate power factor correction circuitry to comply with current standards.

For more information, contact:

ACUTECH
215 SALEM ST., P.O. BOX 2649, DEPT. NV
WOBURN, MA 01888-1249
781-937-0011 FAX: 781-937-3499

AT-11MP AUTOTUNER

LDG Electronics, Inc. announces the AT-11MP, a new model in their Autotuner line of products.

The MP features a dual cross needle meter, providing forward/reflected power and SWR indications. Additionally, an optional remote head is available to allow the tuner to be remotely mounted and still have control over the functions and visual indications of its status.

The MP also features an interface for the ICOM IC-706 radio. While it will operate with any HF radio, the AT-11MP will use the built-in tune button on the IC-706 faceplate and will tune when pressed.

The AT-11MP operates 1.8 to 30 MHz at 5 to 150 watts continuous. The tuning circuit features a switched "L network" and is microprocessor controlled via a Motorola 68HC11. Power requirements are 11 to 14 VDC with a current consumption of 15 to 500mA (250mA average). The AT-11MP will tune practically any coax feed antenna.

The AT-11MP is available assembled or in kit form: fully assembled and tested, $239.00; kit with enclosures, $199.00; and kit without enclosures, $169.00. The optional remote head assembled and tested price is $39.00, the kit price is $29.00. A Balun impedance matching transformer is available to allow the tuner to tune end-feed, long wire, and random length antennas: $25.00 kit and $30.00 assembled.

For more information, contact:

LDG ELECTRONICS, INC.
1445 PARRAN RD., DEPT. NV
ST. LEONARD, MD 20685
410-586-2177 FAX: 410-586-8475
E-MAIL: ldg@ldgelectronics.com
WEB: http://www.ldgelectronics.com

***Showcase your New Products here!* Send all press releases or information/photos to:**

Nuts & Volts Magazine
New Product News
430 Princeland Court,
Corona, CA 92879
or E-Mail to
newproducts@nutsvolts.com

NEW HAMWHIP ANTENNAS

LDG Electronics, Inc., announces the addition of the hamwhip line of single band mobile ham radio antennas to their line of amateur radio products.

These quality antennas feature aluminum and fiberglass construction and fit on a standard 3/8" antenna mount. The antennas are resonant for each amateur band from 6 to 75 meters, including WARC bands, and are "in-band" tunable for the lowest SWR on your favorite frequency.

These mobile antennas are a perfect match to LDG's AT-11 line of automatic antenna tuners, allowing multiple-band operation from one antenna, a boon to mobile operators.

The hamwhip antennas measure eight feet in length, handle 600 watts (nominal), and are black in color. The external fittings are chrome-plated brass and each antenna withstands the effects of many years of sun and road salts.

Each hamwhip antenna retails for $22.95 plus shipping.

For more information, contact:

LDG ELECTRONICS, INC.
1445 PARRAN RD., DEPT. NV
ST. LEONARD, MD 20685
410-586-2177 FAX: 410-586-8475
E-MAIL: ldg@ldgelectronics.com
WEB: http://www.ldgelectronics.com

SS9600 SPREAD SPECTRUM DATA TRANSCEIVER

RF Neulink, a division of RF Industries announces the introduction of its new SS9600 Spread Spectrum Data Transceiver.

This unit features a full transceiver with a built-in modem and can be used in point-to-point systems, as well as a point to multi-point. Capable of 9600bps over the air rate, this unique small package is a true frequency hopper and large systems with as many as 238 units can be configured. Operating in the 2.4 GHz band, no license is required.

This is a true plug and play radio modem for most small system point-to-point control systems. Built-in self-adjusting power control insures excellent communications.

Low introductory pricing, plus a one-year warranty, including technical assistance, make this an excellent solution for reliable communications.

For more information, contact:

RF NEULINK
7610 MIRAMAR RD., DEPT. NV
SAN DIEGO, CA 92126
858-549-6340 FAX: 858-549-6345
1-800-233-1728
E-MAIL: rfneulink@rfindustries.com
WEB: www.rfneulink.com

K8009 CLOCK KIT

Velleman's K8009 15-in-1 LED clock kit is not just a clock! This project also displays date and temperature, has a built-in chronograph with lap time, counts down to a preset date, keeps the score of a two-team game, generates random numbers, throws two dice, counts up or down, includes a chime function, and is equipped with a time or temperature alarm with relay output.

It supports both European and US readout formats for time, date, and temperature.

All options are selectable from a distance with the included RF key chain remote. Wired control is also possible.

The K8009 has an easy to understand menu structure, backup battery facility, and a matching enclosure can be ordered separately.

For more information, contact:

VELLEMAN
7415 WHITEHALL ST. STE. 119, DEPT. NV
FT. WORTH, TX 76118
817-284-7785 FAX: 817-284-7712
E-MAIL: velleman@earthlink.net
WEB: www.velleman.be

High Performance Auto Ranging DMM

New to our DMM line-up and possibly (probably) the best DMM value anywhere! Includes: Analog Bar Graph! Auto-Ranging! Data Hold! Temperature Probe! Frequency Test! Continuity Test! AND MORE!

ONLY $29.95

Available Late December 1999.

Features

Data Hold: Freezes reading for easy checking
Auto Ranging: For easy, precise range settings
Range Hold Control: allows for manual selection of your test range
3-3/4 Digit LCD Display: Reads up to 3260. Easy to read display.
Function Dial: Easy to use to select measurement type or turn unit off.
4 Jack Plug-ins: Safety design with different capacities for different functions.
Diode, Continuity Check Push-Button: For toggling between diode check and continuity check.
Low Battery Indicator: Advises you when it's time to change battery.
Extra Long 44" Test Leads: Helps get to hard to reach places
Screw-On Alligator Clips: Convert one or both probe tips to alligator clips.
Fuse-Protected Circuitry
Built-In Stand: Makes one hand operation easier.
Shock Absorbing Rubber Carrying Case: with convenient probe storage clips and hanging tab. Helps protect the DMM from damage if accidentally dropped.

Measures:
DC Volts: up to 1000V
AC Volts: up to 750V
AMPS: up to 20 Amps (AC & DC)
Resistance: up to 30M ohm
Continuity Check: with audible signal (signal sounds if resistance is less than 20 ohms. Display reads actual resistance).
Frequency: (1KHz to 300KHz) displays both digital and bar graph reading
Transistor hfe Test: Display shows approximate hfe value based on test condition of 10uA base current and Vce of approx. 3V.
Temperature Test: Measures from 0° to 1832° F (probe supplied!)
Diode Test: Tests if diodes are shorted or open

Specifications

Accuracy	
Vdc:	±1.0% reading +5 ditis
Vac:	±1.5% reading +8 digits
Adc:	±1.2% reading +5 digits
Aac:	±1.5% reading +5 digits
Resistance:	±1.5% reading +5 digits
Frequency:	±3.0% reading +5 digits
Temperature:	±1.0% reading +6 digits

Input Impedance: 10Mohm (Vdc/Vac): over 100Mohm on 300 mVdc range
Requires two AAA batteries sold separately.

#CSI9903

2GHz RF Field Strength Analyzer

ONLY $1589

- Frequency Range: 100KHz to 2.060MHz
- Narrow Band FM (NFM), Wide Band FM (WFM), AM and Single Side Band (SSB) Modulated Signals May Be Measured
- PLL Tuning System for Precise Frequency Measurement and Tuning
- LED Backlight LCD (192x192 dots)
- Built-In Frequency Counter
- Hand-Held and Battery Operated
- All Functions are Menu Selected
- RS232C for PC Interface and Printer

#3201

See the web site for details

Removable Hard Drive Rack For IDE/Ultra DMA Hard Drives

We Sold Over 14,000 in 1998!

ONLY $14.95 any qty.

This product can be used with any 3-1/2 IDE hard drive up to 1" high. It includes an electronic keylock for safe removal and insertion. Made of ABS 707 fireproof plastic. Use this product to protect sensitive hard drive data, take your hard drive between work and home or even set up different users with their own hard drives that they physically insert every time they use a PC. Other models available from C.S.I. include RH10 series and RH20 series, which are interchangeable within the same interface design (IDE or SCSI).

Other Models are Available. *See www.web-tronics.com under "hard drive and accessories" for more details and pictures.*

RH-10C-IDE

Removable Hard Drive Rack with Auto Door And Cooling Fan

ONLY $18.95 any qty.

- Auto door on the outer frame
- ABS material of outer frame, High efficiency cooling fan
- Worldwide patent pulling function handle
- CE Approved
- Coating iron bottom cover
- For IDE interface
- For 1" high 3.5" HDD
- Not compatible with our RH10 & RH20 series. Compatible with our RH17-IDE model.

#MR-27

Details at www.web-tronics.com

Auto-Temp Solder Station with Ceramic Element

ONLY $39

- With Ceramic Heating Element for More Accurate Temp Adjustment
- 3 Conductor Grounded Power Cord
- 250°C-480°C (470°F-900°F)
- Fast Heating Feature

SR-976

Extra Tip Options Available. See Web!

For More Info See www.web-tronics.com

CTRL - D to bookmark this site

www.web-tronics.com

Don't forget the dash

- *Easy to Navigate*
- *Includes a Search Engine That Really Works*
- *New Items Added Constantly*

Circuit Specialists Inc.

In Business Since 1971

Mini CCDs (B/W & Color)

Sensational NEW Design for Small Observation Cameras. Smaller and Better!

- ***Ultra Miniature Design***
- ***Black & White Versions Only 25mm x 25mm***
- ***Color Versions Only 32mm x 32mm***
- ***Available in Standard Lens or Pinhole Lens***
- ***All Include Audio***
- ***All Include Pre-Wired Cable Harness for Audio, Video & Power***
- ***12V Regulated Power Supply Required (120mA typical power consumption)***
- ***0.1 LUX Rating (B/W), 1 LUX (color)***
- ***CCD Area Image Sensor for Long Camera LIfe***
- ***Back Light Compensation Circuit***
- ***Built-In Electronic Auto Iris Lens***

Detailed Specs on the Web

VMCW-H11A 32mmx32mmx30mm, Color CCD with standard lens, pre-wired cabling for video/audio, 12V DC Power $149.00 / $139.00 5 or more

VMCW-H12A 32mmx32mmx19mm, Color CCD with pinhole lens, pre-wired cabling for video/audio, 12V DC Power Input $149.00/ $139.00 5 or more

VMPS-718A 25mmx25mmx30mm, B/W CCD with standard lens, pre-wired cabling for video/audio, 12V DC Power Input $69.00 / $59.00 5 or more

VMPS-250A 25mmx25mmx15mm, B/W CCD with pinhole lens, pre-wired cabling for video/audio, 12V DC Power Input $69.00 / $59.00 5 or more

CCD B&W Board Cameras

- ***ASIC CCD Area Image Sensor***
- ***Extremely Low Power Consumption***
- ***0.5 Lux Min Illumination***
- ***Built-In Electronic Auto Iris for Auto Light Compensation***

Detailed Specs on the Web

Detailed Specs on the Web

VM1030PA-B 30mmx30mmx25mm, Pinhole lens with audio, 12V $49.00 any qty.

VM1030A 30mmx30mmx26mm, Standard lens with audio, 12V $49.00 any qty.

VM1035A 42mmx42mmx25mm, Standard lens with audio, 12V with back light compensation $59.00 any qty.

VMCB21 44mmx38.5mmx28mm, with 6 infra-red LEDs, 12V $49.00 any qty.

VM1036A 32mmx32mmx25mm, Standard lens with audio, 12V, reverse mirror image feature $59.00 any qty.

Bullet CCD Cameras

B&W and Color

- ***Smart Rugged Metal Housing***
- ***Extremely Low Power Consumption***
- ***12 Volt***
- ***CCD Area Image Sensor for Long Camera Life***
- ***Built-In Electronic Auto Iris for Auto Light Compensation***
- ***No Blooming, No Burning***
- ***0.1 Min Lux Illumination (B&W), 1 Lux Min Lux Illumination (color)***

Detailed Specs on the Web

VMBLT1020 B&W, 21mm(D)x55mm(L) $59.00 any qty.

VMBLT1020W B&W Weatherproof (no audio), 21mm(D)x58.5mm(L) $79.00 any qty.

VMBLT1020A B&W with audio, 21mm(D)x55mm(L) $69.00 any qty.

VMBLTJC19BW COLOR! Weatherproof (no audio), 17mm(D)x88mm(L) $139.00 any qty.

COLOR CCD Mini Board Cameras

- ***Low Power Consumption***
- ***1 Lux Illumination***
- ***Built-In Electronic Auto Iris for Auto Light Compensation***
- ***Internal Synchronization***
- ***12Volts***
- ***400 TV Lines***

Detailed Specs on the Web

VM3010PA 33mmx33mmx18mm, Pinhole lens with audio $129.00 any qty.

VM3011-A 45mmx40mmx24mm, Standard lens with audio, single board $99.00 any qty.

VM3010-A 33mmx33mmx32mm, Standard lens with audio $129.00 any qty.

new! Hot Air SMD Rework Station

WOW! ONLY $489

Similar Systems Cost 100s More!

ONLY $489

#SR-979

For technicians, service/repair depots and assembly rework. We also stock a selection of nozzles for QFP, SOP & PLCC devices (see our website for selection details). Hot Air temperature variable from 100°C to 400°C (212°F to 754°F) power consumption: 275w max. Auto cooling feature cools system after shut off to extend service life of heating elements and handle. One year limited warranty from C.S.I.

Comes with QFP Nozzle (0.68" x 0.68")

new! O'Scope Offer

30MHz! ONLY $289!

Take Advantage of this low introductory price!

ONLY $289

- *Dual Channel*
- *Dual Trace*
- *Vert Trigger*
- *1 Year C.S.I. Warranty!*

#OSC-1030

Manufactured for CSI by a leading O.E.M. manufacturer. See our website for detailed specifications!

new! 3-1/2 Digit JUMBO Digital Panel Meters *Check these LOW PRICES!*

Available End Of December 1999

AS LOW AS $6.25

- 21mm Figure Height
- 5 Volt Common Ground or 9V Independent Power Supply Versions Available
- Voltage Divider Resistors included and max. Measured Range Selectable by Soldering a Selection Joint
- Easy Bezel Snap-In Design (84mm x 41mm rectangular hole typical)
- "0" Reading for "0" Voltage Input
- High Quality SMD Production Method
- Dual Slope Integration A-D Converter System ±0.5% Accuracy

PM-1028A *LCD* 9V Independent Power Supply Version 1/$12.95 10/$10.89 100/$7.99 250/$6.25

PM-1028B *LCD* 5V Common Ground Power Supply Version 1/$13.95 10/$11.84 100/$8.89 250/$7.15

PM-1029A *LED* 9V Independent Power Supply Version 1/$14.95 10/$12.50 100/$9.95 250/$7.89

PM-1029B *LED* 5V Common Ground Power Supply Version 1/$15.95 10/$13.40 100/$10.79 250/$8.65

3000 Series Digital R/O Bench Power Supplies

AS LOW AS $89

♦*Low Cost Single Output* ♦*High Performance Triple Output*

High stability digital read-out bench power supplies featuring constant voltage and current outputs. Short-circuit protection and current limiting protection is provided. The dual output versions can be used in both serial voltage and parallel current configurations to double maximum outputs. Highly accurate LED accuracy and stable line regulation make the 3000 series the perfect choice for lab and educational use.

Line Regulation: $2x10^{-4}$ +1ma
LED Accuracy: Voltage ±1% +2 digits
Current ±1.5% +2 digits
Wave Line Noise: ≤1mvrms
Dimensions: 291mm x 158mm x 136mm (CSI3003 & CSI3010)
365mm x 265mm x 164mm (CSI3003-3 & 3005-53)

CSI3003: 0-30v/0-3amp Digital R/O Bench PS, $1x10^{-4}$+5mv Load Regulation — $99.00 5/$89.00
CSI3010: 0-30v/0-10amp Digital R/O Bench PS, $1x10^{-4}$+30mv Load Regulation — $149.00 5/$139.00
CSI3003-3: Triple Output 2x(0-30v/0-3amp)+5v, 3amp Fixed, $1x10^{-4}$+5mv Load Regulation — $239.00 5/$219.00
CSI3005-3: Triple Output, 2x(0-30v/0-5amp) +5v, 3amp Fixed, $1x10^{-4}$+25mv Load Regulation — $269.00 5/$249.00

Our Most Sophisticated DMM *We Sold Over 700 Last Year!*

with RS-232 Interface & Software, 3-3/4 Digit, 4000 Count, Auto-Ranging with Analog Bargraph

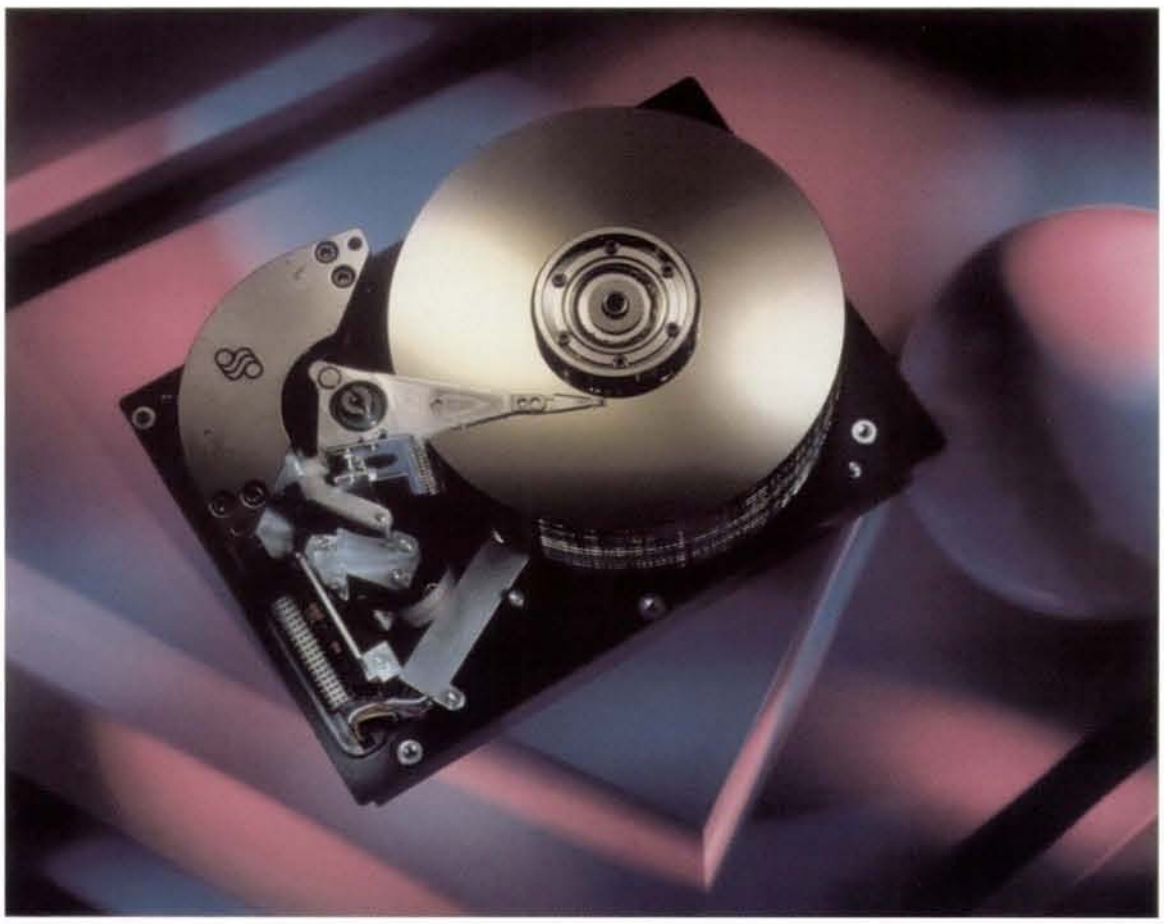
NOW ONLY $129 *Reg. $169*

- True RMS Mode
- 10MHz Frequency Counter
- Time Mode with Alarm, Clock, and Stop Watch
- Dual Display
- 10 Location Memory
- Min, Max, Avg and Relative Mode
- Decibel Measurement
- Cap and Ind. Measurement
- Temperature Mode (C/F)
- K Type Temperature Probe Included
- Pulse Signal for Logic & Audible Test
- Continuity/Diode Test
- Logic Test
- Auto Power OFF/"Keep ON" Mode
- Fused 20A Input with Warning Beeper
- Back Light
- Data Hold/Run Mode
- Safety Design UL1244 & VDE-0411
- Protective Holster
- Silicon Test Leads

More Details on our Web Site

PROTEK 506

MONSTER
47GB SCSI DRIVE



$695
FREE SCSI ENCLOSURE
408 330-5523

Open Windows instantly. Process huge graphic and database files with ease. Make your file server scream with speed.

The 47GB Seagate Elite is the drive you need for serious performance. It features 14 disks and 28 heads for blazing performance 3.5" drives can't touch. The Ultra Wide interface makes installation a snap. A 4MB cache buffer accelerates data transfers.

A special volume purchase brings you brand new drives at low, low PC prices. Shop around. Compare price. No one else can match this deal.

Buy just one drive and build the ultimate workstation. Or add several to take advantage of NT RAID performance. Let us custom-build your multi-drive disk array at no extra charge. Redundant rack-mount trays stack to build arrays bigger than 1,000GB per rack!

Get the speed you need and the reliability you deserve. Get rock solid Seagate quality backed by a warranty of up to six years! Call now! Try your 47GB monster drive risk-free.

CORPORATE SYSTEMS CENTER
3310 WOODWARD AVE., SANTA CLARA, CA 95054
WWW.SCSIDRIVES.COM

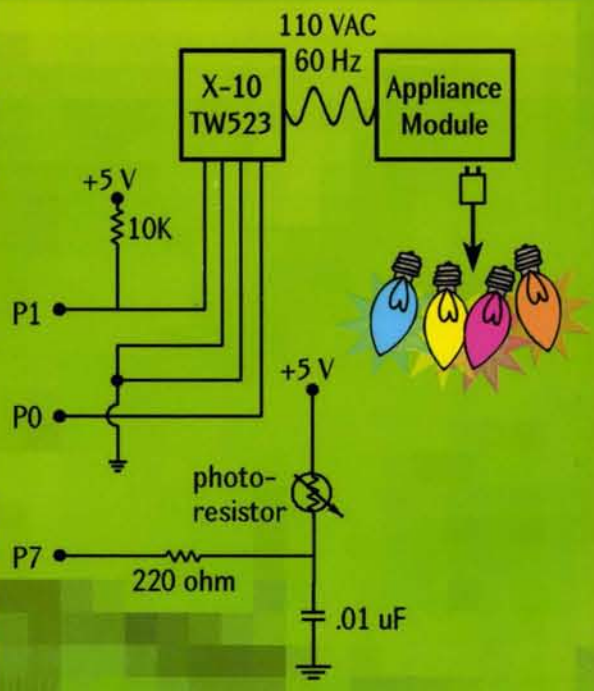
Seagate ST446452W drives are PC, Mac, SGI, and Sun compatible. 5 1/4" Elite drives are sold only in OEM enclosures and disk array trays. CSC carries low-cost, top-quality PCI controllers and SCSI accessories. If you haven't already upgraded to SCSI, call us for help. No-risk guarantee refunds your entire purchase price (less shipping) if you're not completely satisfied within 15 days. Call for your free catalog of hard drives, duplication equipment, and accessories.

Write in 161 on Reader Service Card.

Wishing you the best and brightest of holidays!

Parallax wishes you a happy and healthy set of holidays. We thank you for your support during the past year, and look forward to serving you throughout the next year.

Interested in automating your Christmas tree lights with photoresistor activation? Here's a simple project you can build with your BASIC Stamp II, two X-10 modules (one transmitter, and one lamp unit with brightness), a photoresistor and a couple of resistors and capacitors.



The BASIC Stamp II's XOUT command may be used to fade, and turn the lights on or off at specified times. The photoresistor's resistor/capacitor circuit charge time is determined by the RCTIME command.

Complete code and schematics available from our homepage at www.parallaxinc.com.

For all of your gift giving needs, we now offer **Gift Certificates** available in $25 (USD) denominations ($25, $50, $75, $100, $125 and so on). Contact a Parallax salesperson by telephone at **888-512-1024** (toll free).

www.parallaxinc.com

PARALLAX

www.stampsinclass.com
www.sxtech.com
To order call 916.624.8333 (M-F 8 am -5 pm)

BASIC Stamp and the Parallax logo are registered trademarks of Parallax, Inc.

HAPPY HOLIDAYS FROM PARALLAX!
HAPPY HOLIDAYS FROM PARALLAX!
HAPPY HOLIDAYS FROM PARALLAX!

Write in 194 on Reader Service Card.

NUTS & VOLTS MAGAZINE
430 PRINCELAND COURT
CORONA, CA 92879-1300